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Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 10

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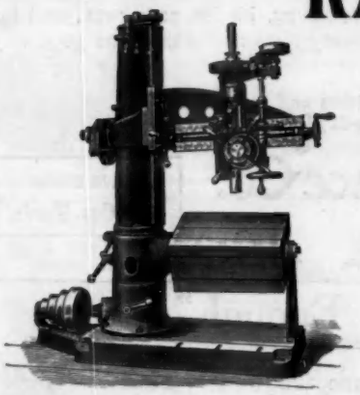

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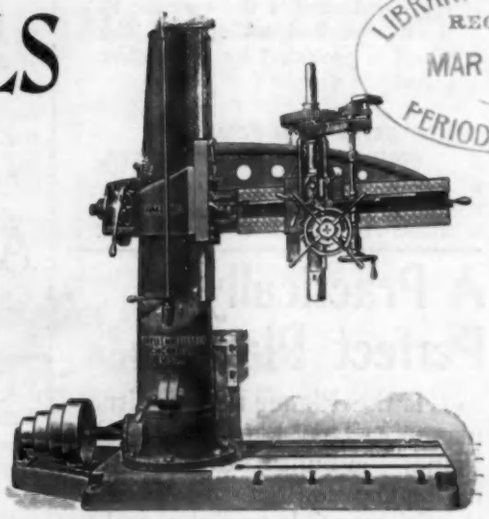

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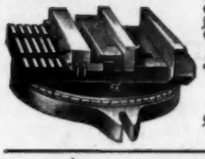

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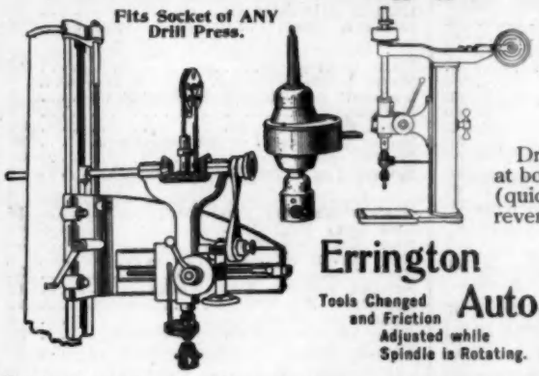

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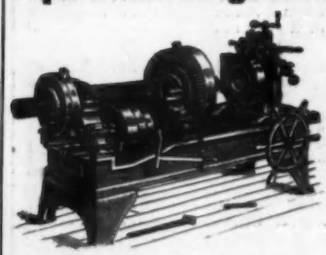

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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 22 NEW YORK, THURSDAY, MARCH 9, 1899 NUMBER 10

Experience With the Premium Plan of Paying for Labor.

BY F. A. HALSEY.

The premium plan of paying for labor was invented by me about fifteen years ago. Owing, however, to a feeling that such an innovation should first be subjected to practical test, its publication was deferred until it could be so tested. The opportunity for this did not present itself until 1890, when I became general manager of the Canadian Rand Drill Company, located at Sherbrooke, Quebec. The plan was put into use there at the earliest p. cticable moment, and the results were so satisfactory that in the folowing year I presented a paper* to the American Society of Mechanical Engineers, in which the plan was outlined in detail. Repeated requests have been made for the publication of the results obtained in Sherbrooke, but such requests have been steadily refused for the reason that, regardless of how unbiased such an article might be in fact, it would, in the reader's mind, be open to the suspicion of bias. The reader would naturally think, and could not be blamed for thinking, that as every child is a prodigy in the eyes of its parents, so such a scheme would be sure to succeed in the hands of its inventor. Many works managers have methods of their own, which invariably work well in the hands and estimation of their originators, and it was inevitable that a publication of my own experience would be received with scant confidence. Moreover, the plan was put into use in Sherbrooke before the accumulation of any large body of data covering the costs under older methods, so that it was impossible to present comprehensive tables of results obtained "before and after," with the simple request to the reader to "look on this picture and then on that." While, therefore, the results were abundantly sufficient to satisfy me they were not of a character to satisfy others. What was needed was the experience of someone who had no interest in the plan other than that growing out of the results accomplished by it, and I preferred to wait for an opportunity to publish such an experience, rather than offer facts which, regardless of their authenticity, were sure to be discredited.

This period of waiting has consumed eight additional years of time, but it is now at an end. A well-known New England manufacturing corporation, employing 125 men in its machine shop, has had the plan on trial for the past two years, and has offered for publication a series of results from its use of the system. But one conclusion can be drawn from this experience, namely, that the system is all and does all that has been claimed for it, that it does cheapen production, that it does increase output, and that it does raise wages. It is not clear how this could have been a matter of doubt. The merits of the system would seem to be self-evident, but inasmuch as they have been doubted, the data to follow are given as, and are believed to be, an unanswerable demonstration.

The only unsatisfactory feature of this presentation lies in the fact that the officers of the company, whose experiences are given, are not willing to have its name published. While this is to be regretted because of the fact that publication of the name would give a special stamp of authority to what follows, readers will at the same time understand the decision.

Inasmuch as it is now eight years since the premium plan was published, it seems best to describe it again, especially since it has been largely misunderstood. Some have looked upon it as a system of bonuses, gratuities, and good will offerings, while in point of fact it is as far as possible removed from everything of that kind. Others, on the contrary, have considered it as essentially the piecework system, to which it bears about the same relation that peace and harmony do to discord and dissension.

While we hear a great deal of the identity of the interests of employers and employees, when those interests are considered in a large sense, it is nevertheless, as a rule, tacitly assumed that between two individuals and in the matter of immediate wages the interests of the parties are antagonistic—the interests of the employer demanding low and those of the employee high wages. A moment's reflection will, however, show that while the employee desires high wages *per day*, the employer desires, and, if he is to live, must have, low wages *per unit of product*, and it is obvious that if these requirements can be harmonized the assumed antagonism of interests becomes harmony instead. It does not need to be demonstrated that an employer can afford to increase wages if he can be assured that it will be accompanied by a more than proportionate increase of output. It is obvious at a glance that a workman getting 10 per cent. more wages than another, but doing 20 per cent. more work, is much the cheaper man to employ.

Now, the premium plan does harmonize the needs of the employee for high wages per day and of the employer for low wages per piece. It sets out to increase wages per day, but by a method that shall insure a more than proportionate increase of output, a method indeed that insures that the increase of output shall be accomplished before the increase of pay, by basing the increase of pay on the increase of output. The system is as simple in principle as this statement. It simply recognizes that the greatest spur to self-exertion is self-interest, and that no system of espionage or discipline or whip cracking can be as effective as one which honestly offers and pays hard dollars for extra work.

The plan in a sense splits the difference between the days-work and the piece-work plans. Under the days-work plan any increase in production by a workman results in an immediate gain to the employer only—the workman getting nothing for his efforts until some time in the indefinite future when merit, coaxing, cajolery, "pulls," or all four together, result in a trifling "raise" in his wages. Under piece work, on the other hand, an increase in production, after the piece price is once set, results in an immediate gain to the employee only—the employer paying the same wages per unit of product as before, until some time in the future when the workman's earnings have risen to a point where they seem to demand a cut in the piece price.

This cut is unavoidable and inevitable, since in no other way can a reduction in cost be made to meet the inevitable reduction in selling prices, but when made it is practically an announcement to the workman that the promises of increased pay through piece work are false—that whenever he has reached a certain more or less clearly defined limit of earnings the rates will be cut and he will be compelled to work harder than before for the old income. This can have and does have but one result—disgust on the part of the workman with piece work. Here and there a shop can be found in which, through unusual ability and tact, piece work has been successfully administered for a reasonable period, but as a whole the above is an outline of its uniform history everywhere. The system is most successful in large works doing continuous manufacturing—of which sewing machine

*The Premium Plan of Paying for Labor, Vol. XII of the "Transactions of the American Society of Mechanical Engineers."

works are a type—and in which long experience has shown the capacity of the various machines. In the usual run of machine shop work, real success with it is rare indeed. The conditions outlined show clearly its fatal defects and at the same time explain the general opposition of workingmen to it. Experience shows it to be a mischief maker and a discord breeder.

The premium plan is an application to production of methods long in use in connection with sales. The plan of offering a salesman a salary and a commission is closely analogous to the premium plan, and if for the salary he is expected to sell a certain minimum of goods per annum, the commission applying only to the excess above this minimum, the analogy is exact. Under the premium plan the workman is paid by the day, and for this daily pay is expected to produce a certain minimum of product, while for any excess beyond that amount he is paid a premium, the amount of this premium being based on the excess and being *less per unit of product than the old wages cost.* It is applicable to any class of work of which the output can be reduced to units.

To proceed to particulars. Taking round numbers for convenience, suppose a workman to be paid three dollars per day of ten hours and to produce one piece of a certain kind per day. The wages cost of the product per piece is obviously three dollars. Now, under the premium plan the proprietor says to the workman: "If you will reduce the time on that piece I will pay you a premium of ten cents for each hour by which you reduce the time." If a reduction of one hour is made the first result to the employer is to save the wages of thirty cents for the hour which has been saved, but against this is to be placed the ten cents earned as a premium, leaving a net gain of twenty cents to the employer and a net increase of earnings of ten cents to the employee. Had the premium offered been fifteen cents, the result of an hour's reduction of time would have been to save fifteen cents to the employer and to increase the workman's earnings by the same amount. The result of any saving is therefore divided between the two, and in a proportion determined by the proportion established between the wages rate and the premium rate, of which more hereafter. It is obvious to all, however, that the gain to the employer does not stop here—the gain due to the increased output from a given sized plant being additional to the immediate cash gain. In the case of large expensive tools the gain due to increased output may easily far exceed the gain due to the reduction of wages paid per piece. This, however, is a far-reaching subject, and the immediate cash gain due to reduced wages per piece is the only one considered here.

1	2	3	4	5
Time consumed	Day wages per piece	Premium earned per piece	Total cost of work = col. 2 + col. 3.	Workman's earnings per hour = col. 4 ÷ col. 1
Hours.				
10	$3.00	$0.	$3.00	$ .30
9	2.70	.10	2.80	.311
8	2.40	.20	2.60	.325
7	2.10	.30	2.40	.343
6	1.80	.40	2.20	.366
5	1.50	.50	2.00	.40

TABLE I.—ILLUSTRATING THE OPERATION OF THE PREMIUM PLAN.

To make the matter more concrete, the accompanying Table I is given to show the results as the time consumed is cut down, the table being carried to the extreme of a reduction of the time by one-half—the above figures of thirty cents for wages and ten cents for premium rates being used.

This Table I is a complete hypothetical exposition of the premium plan, and tables II and III show the actual results obtained in a considerable number of cases. For obvious reasons the names of the jobs here reported are not given, but the general nature of the work and the degree of accuracy involved are given with sufficient clearness. It so happens, and very happily, that the cases included in Table II are of a nature which disarms any suspicion of bias in their selection. They all belong to a single contract and they comprise all of the completed parts of that contract, the good and bad being given together and the whole being totaled and compared at the bottom. It should be

	NATURE OF WORK.	Operation	Dimension Limit	DAYS WORK CONTRACT		PREMIUM PLAN CONTRACT		Old wages cost per piece	New wages cost per piece	Old wages per day	New wages per day
				Time per piece	No. of pcs. in c'ntract	Time per piece	No. of pcs. in contr.				
			Inches	Hours		Hours					
1.	Plain roller, steel	Turn	.003	3.58	35	3.1	10	$ .82	$ .72	$2.30	$2.34
2.	Flat turret lathe job 2-inch stock	Make	.001	1.67	35	.95	23	.37	.25	2.20	2.67
3.	Special screw 15 inches diameter, 1-inch pitch, steel	Turn and Thread	.002 on diam. .01 on length	38.	35	16.35	5	9.50	5.28	2.50	3.30
4.	Complex shaped block, steel	Finish	....	6.3	35	1.8	20	1.57	.52	2.50	2.89
5.	" " " "	Mill	.01	3.7	35	1.5	20	.92	.62	2.50	4.15
6.	" " " "	Plane	.01	.3	35	.3	20	.08	.084	2.30	2.40
7.	" " " "	Mill	.01	1.2	35	.5	20	.30	.21	2.50	4.15
8.	Crooked arc shaped piece, steel	"	.01	1.9	35	.45	20	.47	.12	2.50	4.40
9.	" " " "	"	.02	2.2	35	.85	20	.60	.34	2.75	3.75
10.	" " " "	Plane	.01	4.11	35	2.5	20	.94	.57	2.30	3.10
11.	" " " "	Drill & Ream	....	.83	35	.3	20	.19	.07	2.30	2.40
12.	" " " "	Slot	.02	4.26	35	3.2	20	.97	.76	2.30	2.39
13.	Special stud square end, steel	Mill	.002	1.63	35	.85	20	.44	.31	2.75	3.60
14.	Plain pinion, steel	Turn	.002	3.34	35	1.6	20	....	....	....	....
15.	" " "	Slot	.001	.40	35	.3	20	.10	.10	2.50	2.90
16.	" " "	Cut Teeth	.001	2.31	35	2.6	20	.63	.71	2.75	2.75
17.	Heavy lathe job 48-inch lathe, steel	Turn & Face	.005	38.	1	15.	1	9.88	6.20	2.60	4.10
18.	Milling special complex recess, steel	.....	.002	193.	1	96.	1	48.25	36.40	2.50	3.80
19.	Hand crank, steel	Mill	.02	1.	20	.59	20	.22	.14	2.20	2.42
20.	Small pinion, steel	Cut Teeth	.002	3.28	35	1.8	5	.90	.61	2.75	3.55
21.	Small steel piece	Drill & Ream	.001	.86	35	.12	8	.21	.04	2.50	3.50
22.	Small gear, steel	Cut Keyway	.001	.75	35	.41	21	.18	.11	2.50	3.00
23.	Small bushing, bronze	Turn	.001	1.1	108	.49	74	.26	.19	2.40	4.06
24.	Small steel piece	Chuck	.001	2.23	35	1.7	10	.49	.41	2.20	2.45
25.	Flanged and threaded shaft, steel	Turn	.003	34.6	35	34.5	1	8.99	8.97	2.60	2.60
26.	Segmental nut coarse pitch, steel	Thread	.002	3.	20	1.5	23	.78	.61	2.60	3.20
27.	Special screw coarse pitch, steel	"	.002	5.7	35	3.31	4	1.48	1.23	2.60	3.70
28.	Arc shaped piece, steel	Finish	.01	9.6	35	3.5	20	2.20	.90	2.30	2.70
29.	Large ring, boring mill work, steel	Bore	.003	23.9	35	15.5	6	5.97	4.82	2.50	3.10
30.	Large hexagon nuts, steel	Mill Hex.	.01	2.7	35	1.21	19	.74	.56	2.75	4.04
31.	Heavy pipe, steel	Turn	.05	15.	35	10.	1	3.75	3.00	2.50	3.00
32.	Ring, copper	Turn	.002	12.34	35	3.5	12	2.46	.98	2.00	2.80
33.	Heavy shaft, steel	Rough Turn	.05	37.50	35	24.	3	9.37	7.60	2.50	3.15
34.	Same piece as 26	Mill	.01	2.	35	.44	22	.55	.15	2.75	3.35
35.	Heavy ring, steel	Slot Outside	.01	34.7	35	28.50	4	8.67	7.57	2.50	2.70
36.	Heavy pipe, steel	Bore & Face	.003	62.5	35	30.	4	15.50	10.30	2.50	3.43
37.	Bent piece, steel	Mill	.003	3.4	35	1.1	20	.85	.44	2.50	4.00
38.	" " "	Finish	....	3.9	35	2.	18	.90	.50	2.30	2.50
39.	Small gears, steel	Cut Teeth	.002	2.5	35	1.15	21	.62	.45	2.50	3.80
40.	Heavy ring boring mill work, steel	Bore	.003	23.6	35	25.4	4	6.13	6.35	2.60	2.50
	Totals	.....	....	592.89	....	338.87	....	$147.25	$109.194	$96.60	$124.56

RATIOS OF TOTALS.

New time / Old time	338.87 / 592.89 = 57 / 100	New wages per piece / Old wages per piece	109.19 / 147.25 = 75 / 100	New wages per day / Old wages per day	124.56 / 96.60 = 129 / 100

TABLE II.—RESULTS OF APPLYING THE PREMIUM PLAN TO A SINGLE CONTRACT—ALL COMPLETED WORK HERE REPORTED.

noted that the contract here placed under the premium plan is consecutive with the one carried out under days work, the reductions being immediate. It is, of course, to be expected that in continuous work the reductions will be progressive, and that, favorable as are these results, still better ones will be obtained in future contracts.

Table III gives some additional recent miscellaneous cases to which the system has been applied. There are some apparent discrepancies in these tables, but they are apparent only. Thus there will be seen to be no constant relation between the increased earnings and the reduced cost or time. In some cases the men seem to get most of the saving, and in others the company; while in cases No. 6 and 40 there is an actual increase of cost which does not at first sight seem to be possible under the system. These cases arise from the application of judgment to the determination of the time limit, this limit not being in all cases the man and foreman were positive that no reduction could be made—the results show how well they knew. Case 17 is one of progressive improvement on successive pieces. Owing to the size of the job, the premium was here based on each piece—not on the lot as with the small pieces—and the premium job reported is the last one. This case illustrates the importance of not cutting the rates. While the final earnings will be seen to be large, the wages cost per piece will be seen to have been reduced more than one-third, while the output of the tool (a large, expensive lathe) was increased two and one-half times. Large as were the workman's earnings, the gain to the company was much larger than to him. Considering the progressive reduction as the work was repeated, it cannot be doubted that had the premium been cut as soon as his extra earnings began to amount to something, the workman would have seen that he was not to be allowed to earn beyond a certain limit, and he would have ceased to endeavor to pass that limit, whereas, with the limit based only on what he could do, he kept on, until a result was reached which, at the outset, would have been considered by all concerned to be impossible.

Two fundamental questions must be settled before the system is put into use in any shop, and on these two points hang most of the controversy over it. These are, on what basis shall the time limit be set, and what percentage of the saving shall be given the workman? On these points the original paper before the Mechanical Engineers contained the following: "One method—and the wrong one—is to take the best record obtainable as a base and then offer a liberal premium for its reduction. * * * I have adopted the settled policy of being liberal with the time rate rather than the premium rate." Observation of the system in use (and it is now known to be in use in five shops of medium and large size) has only confirmed the position stated above. More than this, I am now satisfied that the principal danger to the success of the plan lies in the tendency to adopt the opposite course. At first the proprietor is disposed to be liberal, and expecting a small increase only, he offers large premiums. The increase is, however, much more than expected, the workman earns an amount which makes the employer wince, and human nature asserts itself. While the work costs less than before the employer sees that it costs more than it might, and he begins to ask himself the question which he should have asked at the start—"how much must I offer to secure the desired increase?" and to this basis the matter must be reduced sooner or later. This plan is no scheme of the organized charity or benefit distribution kind. Its purpose is to get more work and to get it as cheaply as possible, and the only basis for the premium rate which can endure is that named above, which is the same as that on which all the industrial work of this world is done, namely, how much must be offered to induce some one to do it? If less than that is offered, the work will not be done, while if more is offered, the surplus is a simple gratuity. For work in various fields, from unskilled labor up, the rates of daily pay are settled by wide experience, but in the direction of premiums experience is small. The practice in Sherbrooke was to offer the workman from one-fourth to one-third the total saving, and I am satisfied that for the average machine shop, running on the days-work system, these rates are high enough. In the shop whose practice is here described, the rates range between one-third and one-half, the rate paid more than any other being 36.4 per cent. At the Newton Machine Tool Works, where also the plan is in use, the premium is uniformly one-half the saving. Mr. Newton justifies this high rate by a very broad-gage view of the matter. He does not consider the chief gain to himself to lie in the reduced wages per piece, but rather in the actual time consumed on previous jobs. Where the days-work record was established by a superior man, the time limit has in some cases been placed above the actual record in order to encourage an inferior man to do his best on later jobs. On the other hand, where the days-work time has seemed to the superintendent to be excessive, the limit has been placed below the record. These facts, together with the consideration that the successive jobs are often done by men receiving different daily wages, account for the seeming inconsistencies. The tables give *facts*, and may be depended on as showing the actual workings of the system. Case 14 is one where the days-work record was made by a man and the premium-plan record by an apprentice boy. Because of the discrepancy of wages, the costs and earnings are not carried out, but the reduction of time is given. Cases 41, 42, 43, and 44 belong to work which has been done over and over again, and both work-

	NATURE OF WORK.	Operation	DAYS WORK PLAN		PREMIUM PLAN		Old wages cost per piece	New wages cost per piece	Old wages per day	New wages per day
			Time per piece	No. of pcs. in lot	Time per piece	No. of pcs. in lot				
			Hours		Hours					
41.	Long T shaped piece cast iron	Chuck, Drill & Ream	.125	300	.089	300	$ .0275	$ .0258	$2.20	$2.82
42.	" " " larger size cast iron	" " " "	.178	200	.112	200	.0492	.0317	2.20	2.84
43.	" " " " " " "	" " " "	.275	100	.175	100	.0605	.0533	2.20	3.06
44.	" " " largest " " "	" " " "	.366	100	.183	100	.0805	.0624	2.20	3.41
45.	Cast iron wedge	Plane	3.5	2	3.25	4	.805	.792	2.30	2.44
46.	Box shaped casting	Oblique planing	56.	1	21.	1	14.00	6.25	2.50	2.98
47.	Cast iron wedge	Plane	3.75	2	2.62	4	.825	.727	2.20	2.76
48.	Small pulleys, cast iron	Chuck, Drill & Ream	.18	100	.13	100	.045	.0417	2.50	3.20
49.	Spindle steel	Grind 3 sizes	.6	50	.36	50	.144	.09	2.40	2.50
50.	Small head stock	Mill 3 operations	.45	50	.32	50	.1237	.0925	2.75	2.90
	Totals	.....	65.424	....	28.239	....	$16.1604	$8.1664	$24.45	$28.91
	Totals omitting 46	.....	9.424	....	7.239	....	$ 2.1604	$1.9164	$21.95	$25.93

RATIOS OF TOTALS.

New time / Old time = 44/100 — New wages per piece / Old wages per piece = 50/100 — New wages per day / Old wages per day = 118/100

RATIOS OF TOTALS WITH 46 OMITTED.

New time / Old time = 76/100 — New wages per piece / Old wages per piece = 88/100 — New wages per day / Old wages per day = 118/100

Note that while this table deals with small parts, it also deals with large lots. The ratios at the bottom compare the production of over 900 pieces by each method.

TABLE III.—RESULTS OF APPLYING THE PREMIUM PLAN TO MISCELLANEOUS WORK.

increased output obtained, whereby he is saved from constantly sinking additional capital in plant to the extent he would otherwise have to do. It should, however, be said further, that the Newton works were already on a highly efficient basis before the plan was adopted—a completely organized piece-work system having been in use there for years. In the average shop, changing from the go-as-you-please days-work plan to the premium plan, I do not believe that such rates could last.

A point which many seem unable to grasp is that even with high premium rates, any saving is divided between employer and employee, increased earnings by the latter meaning reduced cost per piece of product to the former. Every additional cent earned by the workman means one, two or three cents saved to the proprietor, the only point to be determined being the part of the total saving which it is equitable for the workman to receive. This point determined, there is no reason for making any change, unless, of course, new methods of production call for a new time base or limit. This limit should of course be changed if such new methods are introduced; but if settled upon a fair basis at the start, there is no reason why the premium rates should be changed. The very starting point of the system is that the limit to the workman's earnings shall be set by the amount of work he can do, and not by an arbitrary ruling of the office. A cut in the rates is equivalent to the office setting such a limit, and if the practice of cutting is once entered upon, progress under the system will stop. When workmen are in effect told that their earnings will not be allowed to exceed a certain limit, it is idle to expect them to exert themselves to pass that limit. The foundation principle will thus be seen to be that the premiums should be such that they do not need to be cut. In introducing the system in any shop, the premiums should at the start be too small rather than too large. If found too small they can be raised, but if too large they cannot be cut without destroying the confidence of the workmen in the system and in their employer's intentions. It must be remembered that in a large proportion of machine-shop work increased production calls for little or no increase of labor on the part of the workman. It is in such cases more a matter of using his wits than his muscles. In other words, he crowds the machine rather than himself. In the blacksmith shop or foundry the case is different. Here increased production usually calls for increased muscular labor, and it would be entirely proper to offer a higher premium in these places than in the machine shop, on the principle already laid down, that without doing so the exertion necessary to increased production will not be made. All experience, however, shows that the increase of output will be far more than any one expects, and the premium rate should be decided with that point in mind. A practicable way of looking at the matter is to assume the output to be doubled, as the extreme possible, and then to decide how much the shop can afford to raise pay to secure such an increase. A premium of ten cents an hour would of course give an increase of a dollar a day in earnings for this extreme increase of production, while a premium of five cents an hour would give an increase of fifty cents a day under the same circumstances, other premium rates giving corresponding increases. It is not, of course, to be expected that any such increase will be made, save in a few exceptional cases, but this method of looking at the question removes it from the region of the abstract and makes it strictly concrete. Taking this view of it, the employer asks himself at the start "What is it worth to produce a given result?" and this is the only rational way to view the subject. It will be seen that a large element of judgment must enter the administration of the system. I am in fact fully convinced that the system puts a sharper test on the capacity of the management than it does on that of the workmen, and this fact will determine the limits of its application. It will, in all probability, for many years to come offer a commanding advantage to the works which are managed in a broad-gage spirit. The narrow-minded manager—the one who considers low-priced labor and cheap labor as synonymous, who cannot grasp the idea that the large output is the cheap output, and who considers driving better than leading—will only make a mess of it, and had better let it alone.

It will be seen that in some cases the earnings shown in the tables are somewhat excessive, but the superintendent of these works considers that the amounts involved in these cases are trifling compared with the advantages obtained.

One thing more should be said. In no case yet where the plan has been tried have the workmen received it with any other feeling than that of suspicion and distrust. They uniformly confound it with piece-work, to which they have deep-rooted objections, and on this account any proprietor or superintendent adopting it must expect some discouragement at the start. Even from this point of view the system has decided advantages in that it does not involve compulsion. It is not a thing to be crammed down anyone's throat, but is an offer simply, and while it will ordinarily be looked upon with distrust, a few will try it, and the potency of increased pay will make missionaries of them to convert the others.

It is proper also to add that while figures from those shops cannot be given, the plan has been just as successful in the other shops where it has been tried as in the one whose experience is here given. The superintendent of the Sherbrooke shop, while decidedly lukewarm at the start, after eight years' experience with it, during four of which it has been entirely in his own hands, could not now be induced to give it up.

The Newton Machine Tool Works speak of it more enthusiastically than I have ever dared to do, and a fourth works, whose name cannot be given, but which is larger than all the others combined, consider it an integral part of their administration, and that its merits are not open to doubt. The experience of the fifth works using the plan is equally promising, but as that experience covers a period of only about six months, the system there can hardly be considered beyond the trial stage. The thing is proven by the hard logic of facts. Wisely administered, the plan will do more to settle the wages problem than anything else that has been suggested.

Indexing.

Many of our readers are using card systems for indexing technical literature, and some of them paste slips from printed indexes on the cards. We have been asked to print our yearly index on one side of the paper only, so that this cutting and pasting may be done. This would not be practicable, but we shall be glad to mail free a duplicate copy of the index to any reader who may desire to use it for this purpose.

Combinations of all kinds being the order of the day, it is but natural, perhaps, that technical and trade papers should join the procession, and this the "Electrical World," "Electrical Engineer," "American Electrician" and "Street Railway Journal" have done by combining under virtually, if not identically, the same ownership, at the head of which is Jas. H. McGraw. This results in the actual amalgamation of the two first named journals under the immediate business management of Mr. Jas. M. Wakeman, late Western representative of this journal. The editors of the new "Electrical World and Electrical Engineer" are Messrs. T. Commerford Martin and W. D. Weaver. W. T. Johnson, who has heretofore owned and conducted the "Electrical World," retires. Mr. Wakeman takes with him to his new position the high esteem and the best wishes of everyone connected with the "American Machinist."

The annual dinner of the Birmingham Association of Mechanical Engineers was held at the Grand Hotel, Birmingham, on Saturday last. The chair was taken by Mr. J. Powell Williams, M. P., Financial Secretary to the Admiralty, who in the course of the evening drew attention to the extraordinary fact that modern weapons were almost entirely the invention of civilians, almost the sole exception being the Shrapnell shell.—"Engineering."

The Management of Ordnance Factories.

The efficiency of agitation is well illustrated by the appointment of the new Director-General of Ordnance Factories just made. Army officers have always looked on posts of this description as their rightful perquisite; and when some years ago, Mr. Stanhope appointed a civilian to fill the office, there was naturally a howl from the military party, who considered they had been robbed of their rightful dues. This outcry was renewed when a civilian assistant was later on appointed to occupy the second position, for it was shrewdly suspected that Mr. Donaldson, the new man, would succeed Sir William Anderson, whose health was known to be failing. When the Director-General died, the military party bent all their energies to getting the policy of Mr. Stanhope reversed, and a soldier put in the chief position. Letters were written to the "Times" setting forward all the arguments in favor of a military Director-General, but ignoring those that might have been adduced on the other side. Where sufficient facts were not forthcoming, imaginary ones were created for the purpose. The "Times" also printed a leading article on the subject which appeared to be thoroughly inspired by the military party; at any rate, if the writer knew many arguments in opposition to the policy he was advocating, he carefully suppressed them. The consequence of all this has been an announcement, made last Tuesday, that the Secretary of State for War has appointed Colonel Edmund Bainbridge to succeed the late William Anderson as head of the Ordnance Factories.

We suppose the military party will be satisfied with this settlement of the question, as a soldier has been awarded the position, but logically they ought to raise their voices louder than ever in indignant protest. Colonel Bainbridge has been superintendent of the Royal Laboratory, Woolwich, and has, it is stated, been engaged in the Arsenal for twenty-three years. Now the great argument brought forward in the "Times" in favor of a Military Director-General was that no one could understand what was wanted in the way of artillery but a soldier, and therefore a soldier must direct the making of artillery; in fact, the only way to learn to make guns efficiently was to command troops making use of them in the field. Colonel Bainbridge, however, has only nominally been a soldier for twenty-three years past, and we leave our readers to judge what be the value of his quarter-of-a-century-old experience in directing the manufacture of modern weapons. We have so recently exposed the foolishness of supposing that a user of guns must needs be the best director of the making of guns, that we will not return to the subject again. The Director-General of Ordnance Factories is not required to invent new kinds of guns—in fact, a proclivity of this nature would almost necessarily be fatal to his fitness for the post. What is wanted is the man who will best see that the needs of the army or navy, as he is instructed they exist, are satisfied in the cheapest and most expeditious manner. A military officer is very unlikely to be able to perform these functions satisfactorily, as his whole course of training and education is against him. It may be that Colonel Bainbridge has learnt and unlearnt enough during the last twenty-three years to make a very good Director-General, but if he turn out satisfactory it will be not in virtue of, but in spite of, his military training. Woolwich, however, has been a poor school in which to learn anything good. The military directorship has had a fair trial there, and if there had been anything good in the principle it would have been developed before now, but nothing good has been forthcoming. To read the "Times" one would think there had never been an abuse heard of before Sir William Anderson appeared on the scene; but those who care to carry their recollections back will remember that the previous history of Woolwich has been one long record of mismanagement and abuse. The system of military control of manufacturing operations has been proved to be rotten over and over again, in fact the history of Woolwich has been one long proof of its rottenness.

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12	1.75	42 " 45	4.5
14 and 16	2.0	48 " 52	5.0
		56 " 60	5.5
18, 20 and 22	2.5	64 " 68	6.0
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The pitches chosen are, on the whole, somewhat finer than the Whitworth standards, though in the case of the sizes most used—say between ¾ inch and 1½ inches—the two systems correspond very closely. This was to be expected, as the standards adopted by Whitworth and Sellers were due to a careful study of the results of many years' experience. The principal factor in fixing them was the necessity of using threads which could be satisfactorily produced in cast iron. Where wrought iron or steel alone is employed, much finer threads can be substituted with advantage; and thus we find in bicycle work ¼-inch bolts with 30 to 26 threads per inch, ⅜-inch bolts with 26 threads, and 9-16-inch bolts with 20 threads per inch, sizes which to a certain extent are becoming standard in the industry. It has long been a disputed point as to whether the Sellers or the Whitworth thread is the better. From a mechanical point of view the sharp corners existing in the former are objectionable, but the form has certainly the advantage

increased output obtained, whereby he is saved from constantly sinking additional capital in plant to the extent he would otherwise have to do. It should, however, be said further, that the Newton works were already on a highly efficient basis before the plan was adopted—a completely organized piece-work system having been in use there for years. In the average shop, changing from the go-as-you-please days-work plan to the premium plan, I do not believe that such rates could last.

A point which many seem unable to grasp is that even with high premium rates, any saving is divided between employer and employee, increased earnings by the latter meaning reduced cost per piece of product to the former. Every additional cent earned by the workman means one, two or three cents saved to the proprietor, the only point to be determined being the part of the total saving which it is equitable for the workman to receive. This point determined, there is no reason for making any change, unless, of course, new methods of production call for a new time base or limit. This limit should of course be changed if such new methods are introduced; but if settled upon a fair basis at the start, there is no reason why the premium rates should be changed. The very starting point of the system is that the limit to the workman's earnings shall be set by the amount of work he can do, and not by an arbitrary ruling of the office. A cut in the rates is equivalent to the office setting such a limit, and if the practice of cutting is once entered upon, progress under the system will stop. When workmen are in effect told that their earnings will not be allowed to exceed a certain limit, it is idle to expect them to exert themselves to pass that limit. The foundation principle will thus be seen to be that the premiums should be such that they do not need to be cut. In introducing the system in any shop, the premiums should at the start be too small rather than too large. If found too small they can be raised, but if too large they cannot be cut without destroying the confidence of the workmen in the system and in their employer's intentions. It must be remembered that in a large proportion of machine-shop work increased production calls for little or no increase of labor on the part of the workman. It is in such cases more a matter of using his wits than his muscles. In other words, he crowds the machine rather than himself. In the blacksmith shop or foundry the case is different. Here increased production usually calls for increased muscular labor, and it would be entirely proper to offer a higher premium in these places than in the machine shop, on the principle already laid down, that without doing so the exertion necessary to increased production will not be made. All experience, however, shows that the increase of output will be far more than any one expects, and the premium rate should be decided with that point in mind. A practicable way of looking at the matter is to assume the output to be doubled, as the extreme possible, and then to decide how much the shop can afford to raise pay to secure such an increase. A premium of ten cents an hour would of course give an increase of a dollar a day in earnings for this extreme increase of production, while a premium of five cents an hour would give an increase of fifty cents a day under the same circumstances, other premium rates giving corresponding increases. It is not, of course, to be expected that any such increase will be made, save in a few exceptional cases, but this method of looking at the question removes it from the region of the abstract and makes it strictly concrete. Taking this view of it, the employer asks himself at the start "What is it worth to produce a given result?" and this is the only rational way to view the subject. It will be seen that a large element of judgment must enter the administration of the system. I am in fact fully convinced that the system puts a sharper test on the capacity of the management than it does on that of the workmen, and this fact will determine the limits of its application. It will, in all probability, for many years to come offer a commanding advantage to the works which are managed in a broad-gage spirit. The narrow-minded manager—the one who considers low-priced labor and cheap labor as synonymous, who cannot grasp the idea that the large output is the cheap output, and who considers driving better than leading—will only make a mess of it, and had better let it alone.

It will be seen that in some cases the earnings shown in the tables are somewhat excessive, but the superintendent of these works considers that the amounts involved in these cases are trifling compared with the advantages obtained.

One thing more should be said. In no case yet where the plan has been tried have the workmen received it with any other feeling than that of suspicion and distrust. They uniformly confound it with piece-work, to which they have deep-rooted objections, and on this account any proprietor or superintendent adopting it must expect some discouragement at the start. Even from this point of view the system has decided advantages in that it does not involve compulsion. It is not a thing to be crammed down anyone's throat, but is an offer simply, and while it will ordinarily be looked upon with distrust, a few will try it, and the potency of increased pay will make missionaries of them to convert the others.

It is proper also to add that while figures from those shops cannot be given, the plan has been just as successful in the other shops where it has been tried as in the one whose experience is here given. The superintendent of the Sherbrooke shop, while decidedly lukewarm at the start, after eight years' experience with it, during four of which it has been entirely in his own hands, could not now be induced to give it up.

The Newton Machine Tool Works speak of it more enthusiastically than I have ever dared to do, and a fourth works, whose name cannot be given, but which is larger than all the others combined, consider it an integral part of their administration, and that its merits are not open to doubt. The experience of the fifth works using the plan is equally promising, but as that experience covers a period of only about six months, the system there can hardly be considered beyond the trial stage. The thing is proven by the hard logic of facts. Wisely administered, the plan will do more to settle the wages problem than anything else that has been suggested.

Indexing.

Many of our readers are using card systems for indexing technical literature, and some of them paste slips from printed indexes on the cards. We have been asked to print our yearly index on one side of the paper only, so that this cutting and pasting may be done. This would not be practicable, but we shall be glad to mail free a duplicate copy of the index to any reader who may desire to use it for this purpose.

Combinations of all kinds being the order of the day, it is but natural, perhaps, that technical and trade papers should join the procession, and this the "Electrical World," "Electrical Engineer," "American Electrician" and "Street Railway Journal" have done by combining under virtually, if not identically, the same ownership, at the head of which is Jas. H. McGraw. This results in the actual amalgamation of the two first named journals under the immediate business management of Mr. Jas. M. Wakeman, late Western representative of this journal. The editors of the new "Electrical World and Electrical Engineer" are Messrs. T. Commerford Martin and W. D. Weaver. W. T. Johnson, who has heretofore owned and conducted the "Electrical World," retires. Mr. Wakeman takes with him to his new position the high esteem and the best wishes of everyone connected with the "American Machinist."

The annual dinner of the Birmingham Association of Mechanical Engineers was held at the Grand Hotel, Birmingham, on Saturday last. The chair was taken by Mr. J. Powell Williams, M. P., Financial Secretary to the Admiralty, who in the course of the evening drew attention to the extraordinary fact that modern weapons were almost entirely the invention of civilians, almost the sole exception being the Shrapnell shell.—"Engineering."

The Management of Ordnance Factories.

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of being more easily originated with exactitude. This point had no doubt a considerable influence on the decisions of the Zurich congress, as the threads there chosen will probably be independently produced in a dozen different establishments. Nevertheless the superiority of the Sellers system in this regard has, perhaps, been over-estimated, since, as a matter of fact, Whitworth bolts and nuts do interchange satisfactorily the world over. Indeed, a 1-inch Sellers' nut will, in practice, fit a Whitworth 1-inch bolt, the toleration allowed in ordinary work being sufficient for this. On the other hand taps and dies in the Sellers' system wear more rapidly than the Whitworth, the sharp angles being points of weakness. The difference is, however, evidently not a serious one, or we should not have had American bolt and nut makers underselling us in colonial, and, indeed, in home markets, as they did last year.—"Engineering" (London).

It is announced that the Baldwin Locomotive Works have just closed a contract for the building of eighty-one locomotives for a new railroad now building in China. This is said to be the largest single order ever taken by the company, involving over $800,000.

Two Milling Jigs.

BY A. H. CLEAVES.

The most important feature in the two jigs described in the following article may be said to be the facility they afford for taking a heavy cut with a small hold on the work, although there are other useful points that will be mentioned. In both cases the work to be done is in steel, and is so shaped that the plane and projected parts cannot well be made of separate pieces combined; and the practice of blanking, drilling and making the hubs in a screw machine or turret lathe, and then punching out the form, is not a good one. It would waste stock, and time in cutting off, and the punching would not leave a good edge for the cams required.

These pieces were sawed off of strips first, and then milled on the edges. In manufacturing large quantities of such pieces, when possible it might be well to mill the forms in strips and saw them off with gang of saws.

Referring to the cuts, *F* in Figs. 1, 5 and 6 is a piece near enough to the original to illustrate the working process. I have not the actual piece at hand at this time. Fig. 6 shows the profile, Fig. 5 the section, the first cut made and the hole drilled, and *F* in Fig. 1 the same piece with both sides milled down.

The castings *C* and *D* for the jig are fitted as shown in Fig. 2, and fastened with screws as in Fig. 3. The steel slide *E* fits the open space between *C* and *D*, and is secured in position endways by the pin *H*. The slide piece is slotted, as shown in Fig. 3, so as to close in on *F* as a holder, and is tightened with the eccentric stud *I*. A sink is cut in *C* for the handle of this stud or cam-pin to work in.

A model *F* being made, and the jig put together and bored out for *A* and *B*, approximately, on the lathe face-plate the slide *E* is put in with *F* full thickness, and clamped in by the cam. Then the jig is trued up with a tester, by the hole in *F*, which with the slide *E* is then removed, and the hole for *A* and *B* is then bored out full size.

Then while the slide-piece *E*, made of tool steel, is yet untempered, the working milling cutter *G*, Fig. 4, is sunk first into one side and then into the other of *E* to a little below the corresponding surfaces of *F*, so the same cutter will not strike the hardened slide *E* in actual service. This is done on the drill press.

It will be seen that the distances *L* and *M*, Fig. 1, measuring the reach of the

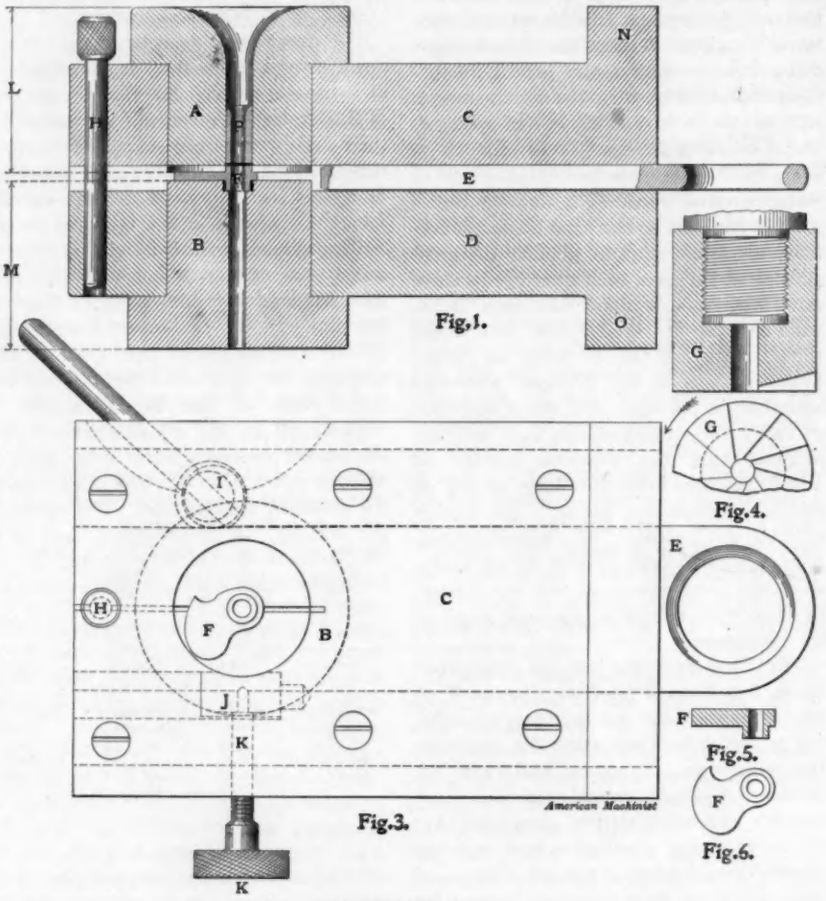

Fig.1. Fig.3.

Fig.4. Fig.5. Fig.6.

A MILLING JIG.

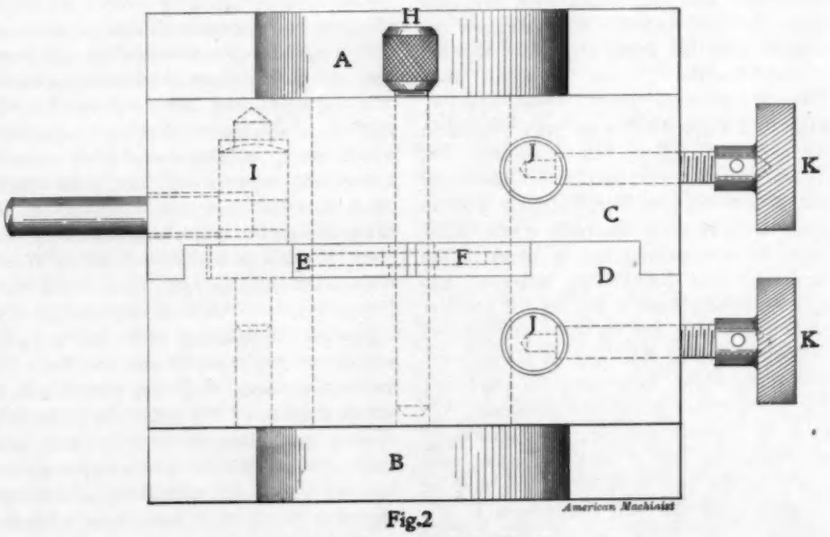

Fig.2

END VIEW OF MILLING JIG.

milling cutter, are the same, and give the measure of each surface on *F* to the face of the jig, or the drill plate. This gives the right depth for the cutter in both cases without changing the latter, although the cut on one side of *F* is deeper than on the other.

Then in making the opposite sinks in *E* and the regular cuts on *F*, the jig, as shown in Fig. 1, is inverted, and the tool *G* makes the cut shown at Fig. 5; the plug *A* being in place, and with projection *N* on the casting C making the bottom resting surface of the jig and support for *F*.

Then placing *B* in the jig and turning the latter over to the position shown in Fig. 1, drill the hole in *F* through *P;* remove *A* and cut the other surface of *F*, perpendicular; the work being all done at one holding. It will be seen, too, that the jig can be readily cleaned and bushed if necessary. A pail of benzine and a brush are always a great desideratum in steel jig work.

In Figs. 7, 8 and 9 another jig and the tool used with it are illustrated. In this case the piece *B* swivels in *A*, and the work held in *B* is revolved around the rotating cutter, as Mr. Swift would say, or rather part way around it. The hole is drilled and the sink around it made previously in a separate jig. *C* is a cap piece over *D*, which last is slotted, and closed with a cam like the other and similar holder. Two dowel pins keep the piece *D* in place, and the cam *H* shows a hole

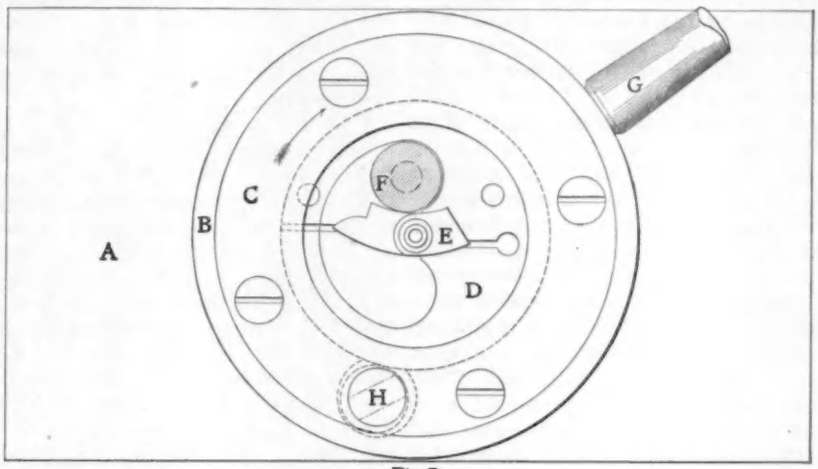

Fig.7

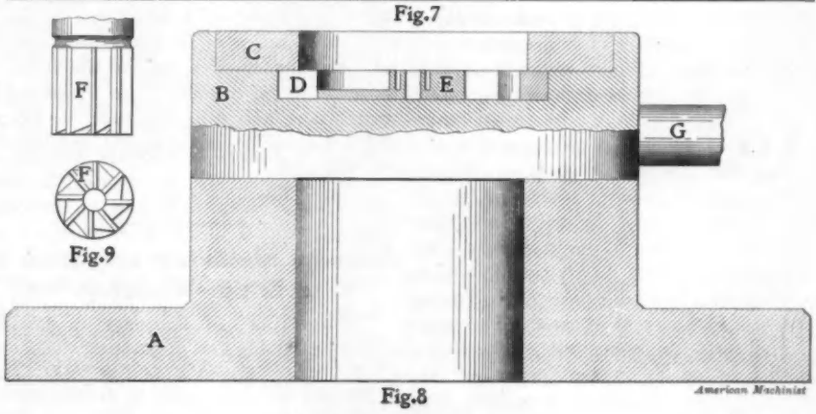

Fig.9

Fig.8

A ROTATING MILLING JIG.

the latter resting on *B*, which is furnished with a sink for the long hub on *F*.

The teeth of the cutter *G* were given an angle for a draw cut, and did very smooth work.

The pieces *J J*, Fig. 2, are tighteners for *A* and *B*, and are pushed up to place and kept from turning by the screws *K K*. They are milled out with the cutter *G*, after which the holes containing them are reamed out to allow them to bind *A* and *B*.

Work like this for guns and pistols, or similarly manufactured articles, can be held on a 1-16 edge and cut down from ¼-inch stock readily. The edges are left very nice, the surface parallel and the hole drilled for a handle. The handle *G* rotates the piece *B*. The base *A* is fastened to the drill-press bed.

The work is revolved against the cutter as shown by the arrow. The opening in *D* for the cutter is milled while *D* is soft, and also enlarged for clearance by moving the jig in and out when cut. An opening should be made (though not shown) below *E* in *B*, and smaller than E to facilitate cleaning.

Peoria, Ill.

A pseudo-mechanical item in a contemporary says: "A single belt should not be subjected to a strain of more than 50 pounds per *square* inch of cross-section."

What Can a Small Shop Do?

BY F. C. BLANCHARD.

To the correspondent who recently asked for advice in regard to getting work for a small shop, I would offer a few suggestions based on my experience in a similar effort.

You can paste in your hat the editorial in the "American Machinist" which advised against undertaking any work which will bring you into direct competition with large shops manufacturing standard goods in large quantities by means of highly specialized machinery. Stick to your jobbing and repair work, keeping your "weather eye peeled" for some new machine to be developed and built, or some standard machine which can be so greatly improved as to merit considerable demand. In this work of development or improvement you are more liable to compete on an equal basis with the larger shops. Your big brothers may have greater constructional facilities at hand, but to balance this you have an opportunity to bestow that personal care and thought of details which the larger shops, as a rule, are not willing or able to give to a new machine a little out of their line. A job of this kind must necessarily go so slow at first that the larger shops consider it rather unworthy of their attention.

In undertaking a job of this character you must realize at once that you are treading on uncertain ground, and you cannot be too careful that your preliminary business arrangements are quite invulnerable before going ahead.

The work may be offered in several different ways, depending upon its state of development. You may be approached by a man well up in some special line of business, who is convinced that some operation can be done, or that some process may be facilitated by a properly designed machine. This man may be well informed and thoroughly practical in his own line, but not in the least a mechanical engineer or machinist, in which case his ideas as to the proper form of his proposed machine are liable to be, to put it mildly, somewhat hazy. If you feel that the machine would be one that you could handle efficiently in your shop, tell your client frankly that you would be glad to start in with him and make first drawings, or a model sufficient to show the proposed machine. This preliminary work is to be carried out to your customer's satisfaction, must receive his written approval and is to be paid for by him, whether anything further in the way of constructing the machine be done or not. This expense is entirely legitimate. To begin on the work in the shop without first agreeing exactly on what you are to do is slow, wasteful and wholly unsatisfactory.

Now, if you understand each other perfectly as to design, inform your customer

that you are prepared to build a machine that will properly accomplish the mechanical movements as shown by the drawings or model, but as to whether these movements will do the desired work in a manner satisfactory to him, he must be his own judge and accept all responsibility. Take the ground that your customer will reap every benefit of success and must therefore shoulder all responsibility of failure.

If possible, get the work at a reasonable rate per hour and fair profit on materials, with due allowance for necessary waste. If you must make a lump price, take time enough to figure the job properly, and in making your estimate consider each piece separately; in fact, get right down to a fair price for each operation on that piece. Add to the price for all the finished parts a sum sufficient to cover fitting and erection, painting, skidding, delivery on cars, etc. When all this is arranged and the matter of payments agreed upon, as indicated later in this article, go ahead on the work, giving it all the thought you can without getting so deeply absorbed that you neglect other work in your shop that must be kept moving in good shape at the same time.

Again, you may be asked to figure on a machine which has been developed by a mechanical engineer to the extent of detail drawings and specifications. In this case be sure that everything is clearly shown and specified, and have any doubtful points settled in writing when you put in your proposition for the work. State in your proposal that you will do the work according to the drawings and specifications for so much money, any changes or additions to the work to be paid for at a price to be mutually agreed upon, or, in case of failure, to agree to be charged extra at regular rates for day work and materials.

Be careful not to guarantee the successful operation of the machine. In carrying out the designs and specifications you have fulfilled your contract. The engineer who made the plans is responsible for the rest. You may be tempted to offer suggestions of changes during the progress of construction, but, as a rule, don't do it, for if anything ever goes wrong afterward the cause may be traced back, justly or unjustly, to the changes made at your suggestion.

A sample machine may be presented to you for an estimate. In this case the chances of misunderstanding are small. As a rule, however, some changes or improvements on the sample machine are desired to be incorporated in the new machines, or perhaps the quality of work may have to be improved, or again the cost of the machine may have to be reduced. If you are to make any of these changes, be sure that such changes are thoroughly understood and agreed upon as to details in your proposition before the work is begun.

Don't agree to perform in a month a contract that you think will take six weeks, for in such a case it will probably be two months at least before the job is done, and your customer during the last month may change in his bearing toward you, from a friend to a foe of the worst description. He may make certain business arrangements timed from your promise, which, if deranged, will cause him serious annoyance and expense.

It is customary for the owner of the machine to pay for and own the patterns. If you have the facilities, you can generally figure to make the patterns of any machine that may be offered. If the patterns are to be made outside, it should be understood that you are to be consulted and to have authority in the matters of finish allowance, fastening devices and other points conducive to the production of castings that can be machined to the best advantage.

Another consideration, a little more complicated than the above, is that of tools, jigs, templates, etc. The amount to be spent for special tools is largely a matter of judgment, and must be determined for each particular case. In general, if your prospective contract is for only one machine, and this very experimental in its nature, and liable, before reaching good results, to be largely altered, then figure on making only such tools as are absolutely necessary for a good job, or as will be paid for in the saving on one machine. But if you are estimating on a lot of machines subject only to minor changes and with a probability of future orders for the same, then refer to your customer. Show him that the more he is willing to invest in special tools, the less it will cost to build the machines, at the same time extending the number of parts on which interchangeability will be secured. Also indicate that it would be poor policy to make only such special tools as would be justified on an order of ten machines if a hundred such machines are liable to be wanted before a year is past. The cost of producing the special tools should invariably be borne by the owner of the machines. Don't quietly figure that you are liable to get duplicate orders later on and spend half you get on your present contract for tools. If your customer knows his business, he will expect to pay for special tools with the machines, and thereby own them; so that in case he should decide to place subsequent orders elsewhere, he will get some benefit from tools already made in the price that he has to pay for his work. You can argue strongly on this point. Let your customer furnish the capital for his own enterprise. Unless you have better luck than most of the rest of us, you will need all your capital for your own requirements.

Don't tie up on large contracts without arranging for payments as work progresses. Contractors in other lines get 75 or 80 or 90 per cent. of value of work done each month, the remaining 10 to 25 per cent. being held until final completion of job. A new machine, involving drawings, patterns, some special tools, castings, forgings, etc., cannot be built and tested, generally, in less than several months. Meanwhile, Saturday night is coming around about once a week, and your landlord, foundry, steel and supply men will expect their monthly settlement of account just the same. And it is in the interest of your good name and credit to give it to them. Also you have a chance to test the willingness and ability of your customer to make satisfactory payments before getting in too deep on the job. Your customer cannot raise any valid objection to your request, provided you have it understood before the work begins, and provided he has confidence in your honesty and ability as a machinist. If he lacks these, you had better not try to do business together.

If he says he will pay the bill when the machine is tested and proved satisfactory to him, answer simply that you propose to do the work in conscientious obedience to the drawings and specifications or sample furnished, that the work in its progress will always be open to his inspection, or to that of his representative, both as to quality of materials and workmanship. An admission from your client that even with these precautions the machine might not work right establishes the fact that he regards the whole thing as something of an experiment. If he still insists in proposing to pay only for a satisfactorily operative machine, he is, in fact, asking you to take the burden of a risk of which he is to reap all the benefit. It is a one-sided proposition, and it is the rock on which the majority of unsuccessful machinists are stranded.

Boston, Mass.

American Machinery and Stock in a British Workshop.

"Engineering" of February 17 has an article describing and illustrating the shops of Mr. W. S. Laycock, at Sheffield. The conclusion of the article is as follows:

"Before dismissing this subject we will venture to add a few words, even at the risk of becoming tedious, and certainly of saying something which must prove unpleasant. We must preface what we are about to say by stating that Mr. Laycock is an Englishman; in fact, he is a Yorkshireman, which a good many people think is the most English sort of Englishman. Although his inclination and sympathies are entirely towards the country in which he was born and brought up, he has been obliged to go across the Atlantic not only for nearly all the special tools needed in his works, but also for a great deal of the material which he uses. This is not from inclination; and, indeed, Mr. Laycock constantly laments the necessity of spending money out of his own coun-

try. In regard to machine tools of the class used in these works, there is no need to say much to engineers; the lesson has been too well rubbed in of late by practical experience. The case of the cock-making machinery here described is a typical case in point. At first, as stated, ordinary engineers' lathes were used; then the representative of a well-known German firm came along, and offered to design and supply special machinery, guaranteeing a substantial saving on the old method of manufacture, acceptance and payment depending on the promise made being carried out. The machinery was made and delivered, and proved a substantial advance on the old methods; then a representative of Messrs. Pratt & Whitney offered to go one better, guaranteeing a further considerable saving, again making the fulfilment of the guarantee a condition of the contract, and the result has been so eminently satisfactory that it has paid to discard the German machines; and, indeed, the American tools paid for themselves in a very short space of time. It was not that the British tool makers did not have a chance. They were not only encouraged, but invited to compete; but the most that could be obtained from them was a small modification of existing designs which have been standard for very many years past. That, however, refers to machinery; in material Mr. Laycock has had the same experience. The brass rod he uses comes from America, because it is cheaper, and not only of equal quality, but decidedly better than that which can be bought at home. American iron castings, especially malleable castings, are better and cheaper than those which can be got here; the deliveries are more regular, and when a new part is needed, it can be obtained from across the Atlantic more expeditiously and with greater certainty that it will be what is required than is the case if it is ordered in England.

"We give an illustration of a malleable casting, which is used as a clip or collar for fastening the india-rubber pipe which makes connection between coaches in the train-heating apparatus. On the occasion of our own visit to these works, we took three specimens at random from the stock, and straightened them all out, as shown in Fig. 7, without sign of a crack, and we were told by the attendant that if a thousand were tried the result would be the same. The test is not beyond what malleable casting ought to stand, but the manager of these works states that he is compelled to go to America, not only on the score of price, but because it is only in that way he can be assured against failures.

"A large number of coiled springs are used in these works. They all come from America. Other instances could be given, but it is needless to multiply examples. It is this that makes it a depressing thing for a patriotic Briton to go through these works, in spite of the fact that they are so well arranged, and are so full of beautiful mechanical features that they must be, from one point of view, a delight to an engineer, and, moreover, are so well ordered that they are more like a vast physical laboratory than an ordinary money-making establishment. We are conscious that what is said here will appear to many like a fouling of one's own nest, but we think it a more patriotic thing to attempt to bring these matters home to our countrymen in time, rather than pursue the ostrich policy of burying our heads in the sand, to shut out an unpleasant prospect, until, perhaps, it is too late to make amends, or at any rate becomes far more difficult. It may be urged that trade has been so good of late that British manufacturers have found it impossible to execute these orders for special machine tools. The business, however, has been going on for some time past, and we notice that British makers are keen enough to sell machinery that does not need thinking for its production. It is when one gets out of the old ruck of design that the American mechanic secures the business.

"There is one thing to be said in excuse for British machine tool makers in this connection, and perhaps that will be best explained by a simple statement of fact. Not very many months back the representative of an American firm, celebrated as designers of automatic labor-saving machine tools, put certain suggestions before the principal of a large firm of brass finishers in this country. As a consequence, the firm determined to remodel their system of production, substituting automatic machines for the old primitive methods of hand labor. The arrangements were all settled, and, we believe, orders actually given, when the matter came to the knowledge of the workmen, who intimated that if these machines were introduced they would go out in a body. The firm did not care to enter on a contest with their men, and the orders were cancelled. This was before the engineers' strike, and whether the firm have since carried out their original intention we are not aware, but if they have not they have only themselves to thank if they find their business dwindling."

Perhaps it would be comforting to Mr. Laycock to reflect upon the fact that none of his money comes over here at all, and that the credits created in favor of American banking institutions by the deposits of cash or checks in Birmingham or London banks to the credit of American manufacturers or their agents are balanced partly by British exports to this country and partly by credits here in favor of his countrymen who own our lands, our railroad or other stock shares and our bonds, and who in this way receive their rent, dividends and interest. They take no American money, and must take machinery or wheat or beef or mutton.

The idea that money flows from one country to another is a fallacy. International trade is not carried on in that way.

The machinery and stock which Mr. Laycock and other Englishmen import from America is good machinery and stock. It is helping to keep up and strengthen British manufacturing industries, and if imported in sufficient quantities and properly used will avert a threatened disaster to those industries. This practice does not in the least lessen Mr. Laycock's patriotism, and ought not to give him a single twinge of conscience.

If we did not send machinery to England, we would have to send more of our other products which are declared to have so seriously depressed British agriculture (by which is meant British landlords), or we could take and pay for a less quantity of British goods. Viewed broadly and a little more deeply, this business will be seen to hurt no one, but on the contrary, to benefit all concerned.

The Engineer of To-day.*

The engineer of to-day needs no introduction anywhere. He has made for himself a name; he has achieved a standing; he has come to be an important factor in modern life. All people acknowledge his importance. All languages record his achievements. No river is too wide for him to bridge; no mountain too high for him to scale, nor too difficult for him to tunnel; no distance too great for him to traverse with copper wire to carry the message of hope or of joy, or to transmit the voices of dear ones, or to light our homes, or to conduct and apply distant sources of power to the benefit of mankind.

. . . . .

There can be no other engineer than the engineer of to-day. The engineer of yesterday is almost forgotten. His methods, once the glory of his age, are in many instances obsolete. His work, however, stands as a monument to his ability and his energy, but to-day we do the same work differently, and we hope, better, but of this posterity must judge. We do it at less cost, but for that we should not be too proud. The world moves, and in no branch of science faster than in engineering. Yesterday, the crank, or the specialist, or the advanced student, told of some new discovery in the laboratory. To-day a thousand men apply it in a thousand different ways; to-morrow something better is developed. The engineer, therefore, to have any standing, to accomplish any results, or to achieve any name which he may be proud to hand down, must be an engineer of to-day.

. . . . .

There is no success for the engineer

*From an address by William H. Bryan, retiring president of the Engineers' Club of St. Louis.

who is not of to-day. He must be active, alert and conscientious. He must not shirk responsibilities; he must meet duties unflinchingly. As a rule his work is as open as the day. He cannot hide it under a bushel. All men may know of the disasters which follow incompetency. All men, too, may know of the success which follows faithfulness. Engineering works there have been in all ages, and engineers, too; but the position and importance of the engineer has grown with the centuries —grown perhaps faster than ever before in this nineteenth century. Now, at its close, we see the engineer justly achieving a rank among his fellows of which he may well be proud. We see, as he develops capacity for greater duties and responsibilities, such duties and responsibilities await him, and are thrust upon him. No station is too high for him; no responsibility too great; no duty too severe.

. . . . .

The engineer of to-day has many duties. He cannot live unto himself; he cannot shut himself up, clam-like, from his brothers. To achieve his best work he must be in touch with his fellows. He must avail himself of the researches and advancements made by others working along similar lines. He must meet them face to face; he must discuss his difficulties with them; and he must receive inspiration direct from the master minds of his profession. And inasmuch as he cannot exist without availing himself of the work of other engineers, it devolves upon him to perform his share of the work of education and progress. The man who absorbs everything, and does not himself contribute to the general fund, has no right to call himself an engineer. It is distinctly characteristic of the true engineer of to-day, that he is not a sponge. He recognizes the obligation to give as well as to receive.

A Large Special Horizontal Boring and Milling Machine—"Made in Germany."

The half-tone and accompanying drawings show an interesting special horizontal boring and milling machine built by Droop & Rein, Bielefeld, Germany. The machine at first strikes one as merely a reproduction of the familiar horizontal boring mill of the American builders, but upon looking into it a little it will be found to differ in important particulars, and to possess novel features of its own. The size of the machine is perhaps not its least important feature. Its hight, 9 feet 4 inches from the bottom of the baseplate to the center of the boring bar, necessitates placing the machine in a large pit, with space for getting all around it, and with the working floor more than 5 feet above the pit floor, as indicated by the standing of the man at the extreme right in the half-tone.

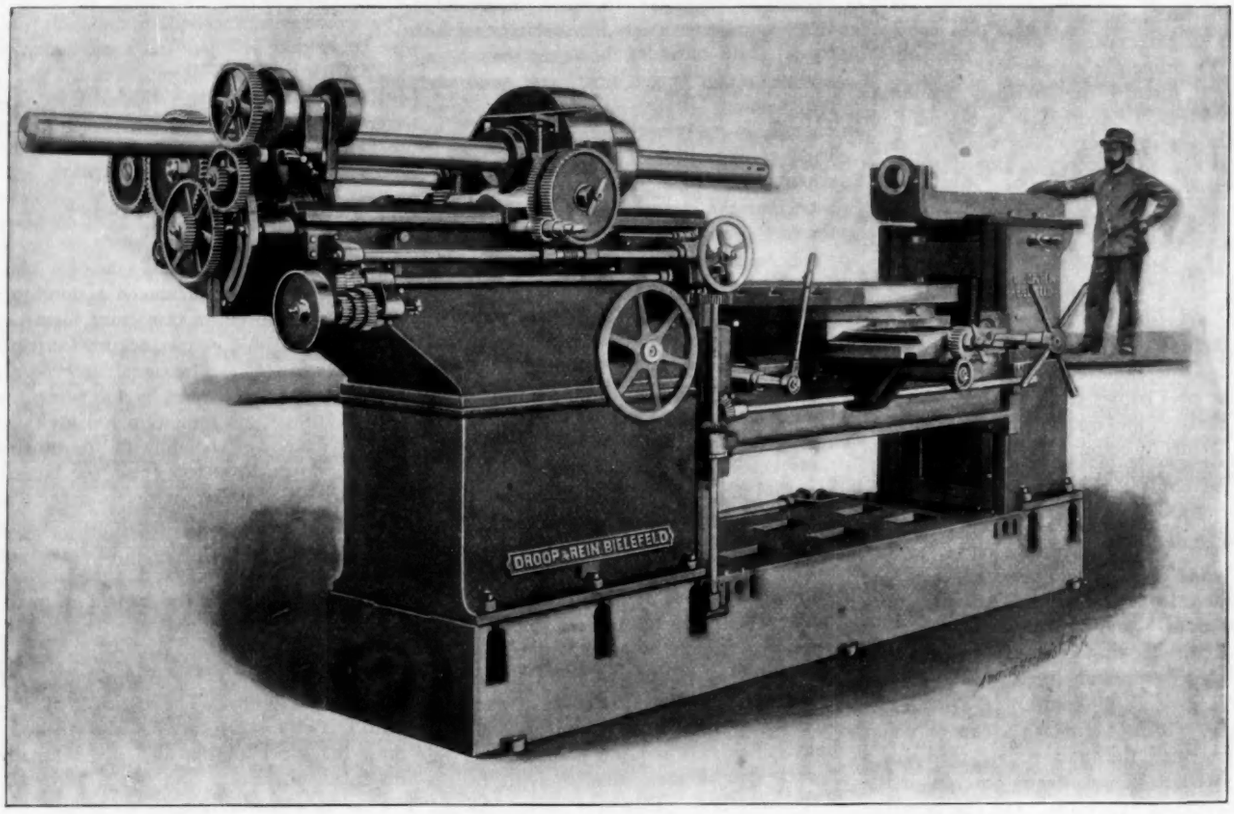

FIG. 1. A LARGE GERMAN HORIZONTAL BORING MACHINE.

The machine was designed for boring and finishing forged or cast-steel cylinders open at one end only, and often with two or three cylinders united in one solid piece. The boring bar for such work could therefore not be supported at its outer or cutting end. Another essential condition for satisfactory work was th t the working length of the bar and its consequent spring should be the same for the entire depth of the bore. In use, therefore, the projecting length of the bar is adjusted according to the depth of the cylinder to be bored, with a little length of bar to spare, and the bar is then clamped securely in a chuck on a sleeve in a traveling head, by which the bar is carried and driven. The traveling head has a linear movement of about 48 inches. The back end of the bar slides freely through a revolving sleeve in the back bearing, and while the bar is driven by a spur gear on the sleeve in the traveling head, the feed movement is taken from the revolving sleeve in the back bearing. For boring ordinary cylinders open at both ends, the bar is extended so that its farther end is supported by the outer bearing in the usual way. The bar is of tool steel, 7¼ inches diameter, and splined its whole length. Its guide in the traveling head is a long sleeve with two bearings, the spur driving gear between them and the clamping chuck on the forward end. The chuck has a cross slide loosely fitting the bar, with a key fitting the spline in the bar and a set-screw behind the key. In tightening the set-screw

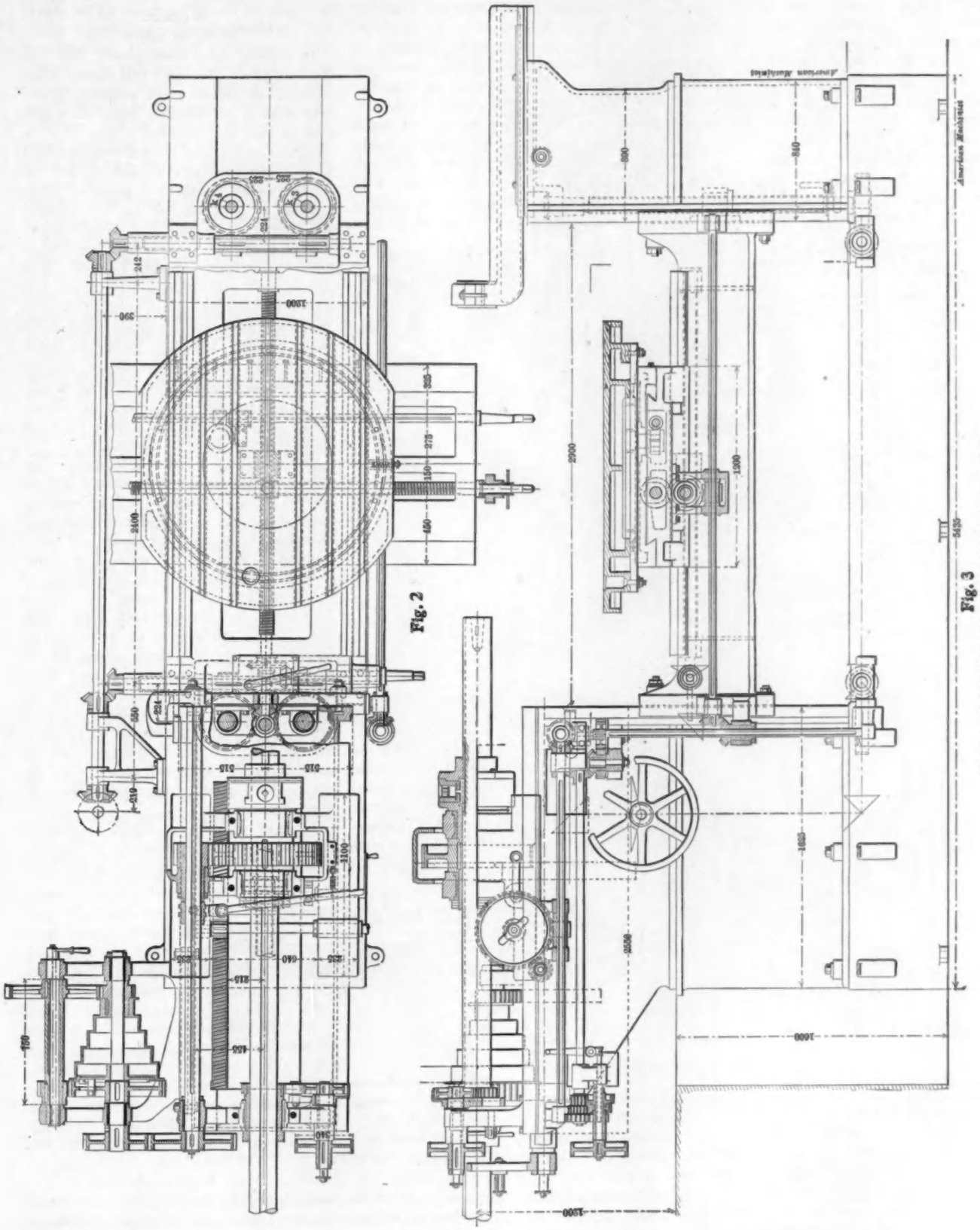

Fig. 2

Fig. 3

PLAN AND ELEVATION OF LARGE BORING MACHINE.

the slide is free to adjust itself in the same direction, so that there is no forcing of the bar out of truth by side pressure.

The bar can be fed either by a lead screw and change gears, giving it a regular screw-cutting movement, or by rack and pinion driven from the feed pulleys by triplex change gearing, worm-gear and friction clutch. The machine is driven by a five-step cone and back gearing at the rear of the machine, and by a coupling and lever arrangement the driving gear can be stopped automatically when cutting threads up to a fixed point.

The hight of the base is 24 inches. The table has tongues at each end fitting vertical grooves in the uprights, and is secured by T-bolts in the slots. The table is raised and lowered by two screws at each end, 4 inches diameter, and all operated simultaneously by the power, with minute hand

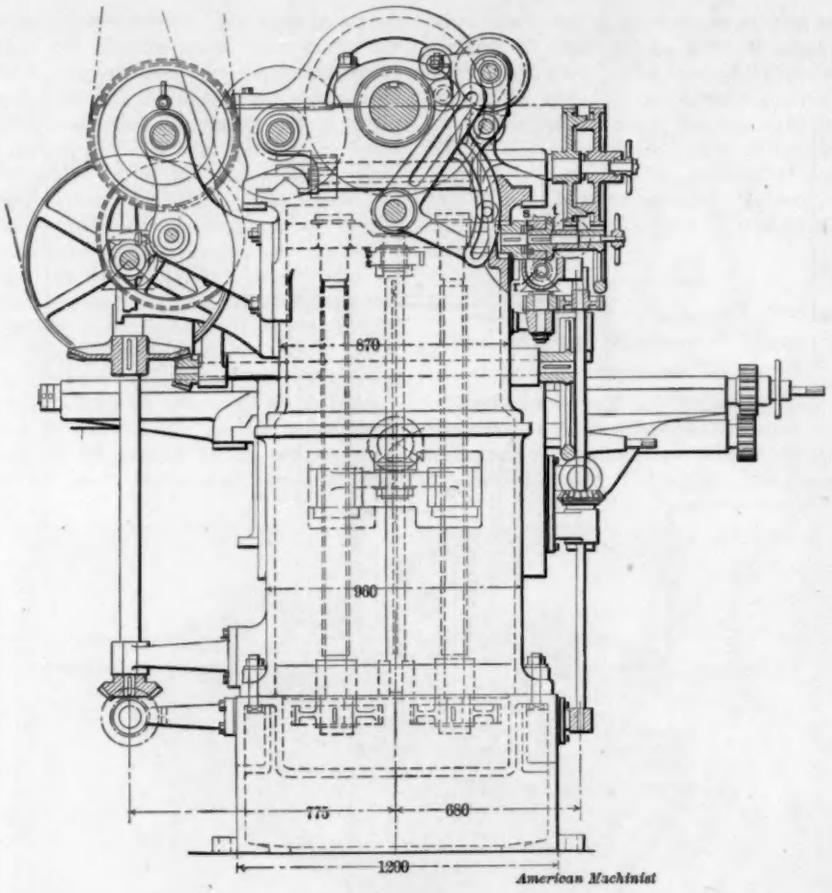

Fig. 4

END ELEVATION (PARTLY IN SECTION) OF LARGE BORING MACHINE.

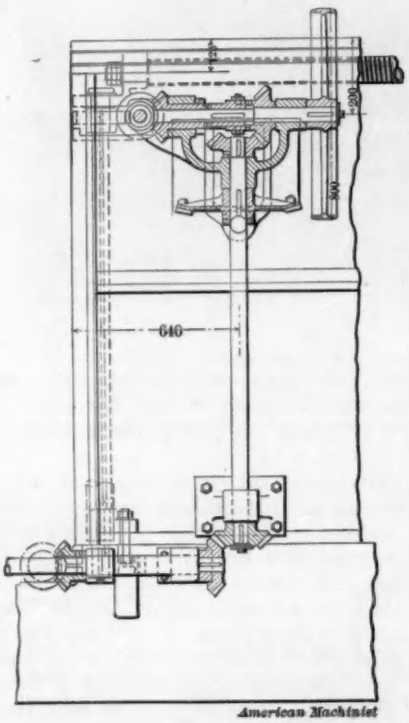

Fig. 5

TABLE OPERATING DETAILS.

adjustment when required for setting the work. There is a cross-feed to the table for milling. The round table, 70 inches diameter, is rotated by an inverted internal gear and pinion, hand-operated. The drawings are reproduced with the original metrical measures.

The Power of a Horse—Scoop-Wheels.

BY W. H. BOOTH.

In writing upon horse-power, Mr. Tecumseh Swift complains that James Watt selected an inconvenient number, 33,000 foot-pounds per minute, when he might just as well have selected 32,000. Had he done this, or selected even 30,000, he would have saved considerable figuring, for the latter number would have given an exact number of hundreds, or 500 foot-pounds, per second. It is said that Watt's determination of the horse-power was made from observation upon London dray horses, and that the figure he found was 22,000 foot-pounds per minute, as the rate of doing work for a certain number of hours per day, and that, having so determined, he increased the figure exactly one-half, and thought thereby that in selling them engines to do so many horse-power his customers would have no cause to grumble at their performance.

It does seem a little unfortunate that standards at this late day should still be chosen with so little regard to existing standards. Let us consider the electrical standard of power, the watt or volt-ampere. There are 746 watts in a horse-power. Practical men get to speaking of a kilowatt as 1⅓ horse-power, as it would be exactly, had the watt been a very little less, so that 750 went to the horse-power. It seems a pity that there should be 746 watts to a horse-power, and that there should be about 43 heat units to a horse-power minute. The probability is that when the electrical standards of the volt, ohm and ampere were first formulated, the growth of the electrical industry in the direction of power transmission was unforeseen.

Now as regards the horse, mechanical men have become so tied up to the mechanical standard of a horse-power that

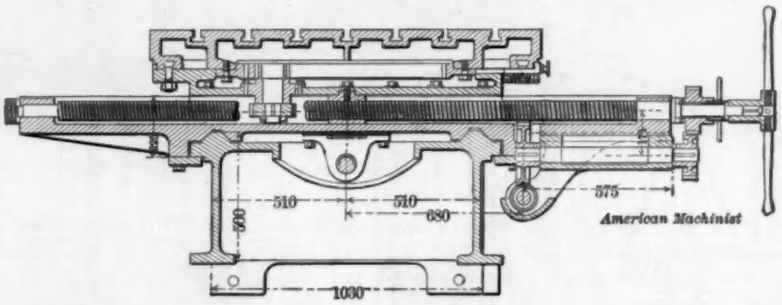

Fig. 6

DETAILS OF CARRIAGE MECHANISM.

The money value of the product of the coal mines of the United States is three times as great as that of the gold mines. The product of the anthracite fields alone exceeds in value the gold output of the country, including Alaska and also Canada. The industrial value and stimulus of the coal over the gold is incalculable and beyond the scope of figures.

they have committed some very serious errors in practice and design. A horse at best is but a poor means of starting a car from a state of rest, though fairly useful in maintaining it in motion at a moderate velocity when once accelerated to that velocity. But two horses are a vastly more powerful means of starting a car than a two-horse electrical motor. To us at the

present day the idea of running a two-horse car by means of a two horse-power motor appears supremely ridiculous. But it ought not to appear ridiculous. The fact that the two horse-power motor is so useless simply ought to tell us that our early ideas as to the horse were very inaccurate, and it is now generally conceded that the power exerted by horses when making a start is several times their normal effort. Yet the early electrical cars were very much underpowered. This is not so to-day, when cars are fitted with a power far in excess of anything that could have been exerted by several horses; but this is because rapid acceleration has been found to pay. Notwithstanding the error made in the case of cars, the same has been repeated in the case of the automobile or road vehicle. Although now better equipped, all the early benzoline motor cars were only fitted with engines of a power sufficient to run the vehicle at a good rate of speed, but they were by no means equal to sending the vehicle up hill. The well-known limits of the internal-combustion engine, which cannot be pushed, has led some engineers to discard the principle and take up the manufacture of road vehicles fitted with steam power.

The steam engine will almost always be found capable of responding to a call for further energy. These steam-driven vehicles are fitted variously with boilers heated by coal or by oil. In the West of England a firm of manufacturers who have to convey wool and other articles over bad roads—mere lanes—with heavy gradients of 1 in 10, and even 1 in 7, have found the wear and tear of horses to be very great, and have had for about a year a steam road van at work. In spite of the experimental nature of the work, they have found that the cost per ton-mile, including all charges and interest, is less than the previous cost with horses, and, moreover, that work has been undertaken which formerly they did not attempt. The experiment has been by no means on a laboratory scale. Over 3,000 miles have been traveled, and over 1,000 tons have been conveyed from mill to mill at an expense in oil of about one half-gallon per net ton-mile (English gallon of 277¼ cubic inches). The legal limit of weight is 6,720 pounds, and this is declared to be too small, an extra thousand pounds being capable of being well applied to strengthen details. The total cost per net ton-mile is about 16 cents, which seems rather heavy. Oil, of course, costs about 10 cents per gallon.

It is estimated that if the best Welsh coal were used instead of oil the cost would only be about 13 cents per net ton-mile. In this connection it should be noted that the roads, excepting the very excellent highroad, were very bad, as anyone who knows a Devonshire lane may imagine, and thus the power expended is very great, there being no return of energy on a down grade to help to balance the heavy up-grade effort. As the lanes are barely wide enough to pass two vehicles, it is evident there can be no reduction of grade by adopting a zig-zag course, and the engine power must be sufficient to surmount the ruling grade of 1 in 7. Now a grade of 1 in 7 means a pull of over 300 pounds per ton, which, added to the ordinary tractive resistance, implies a very big pull for a loaded wagon of a total weight of, say, five tons. The problem of automobilic vehicles is thus seen to be one of some magnitude. All ideas of power based on the ordinary horse must be put to one side, while at the same time the wide range of power over which a horse works must be aimed at. So far only steam and electricity appear to afford such wide ranges. Gas power will not do it. Electricity is out of the question in the far country districts, while oil resembles gas in its narrow range of action. Electrical accumulators also are out of the question in such rough work, as well as by reason of their weight.

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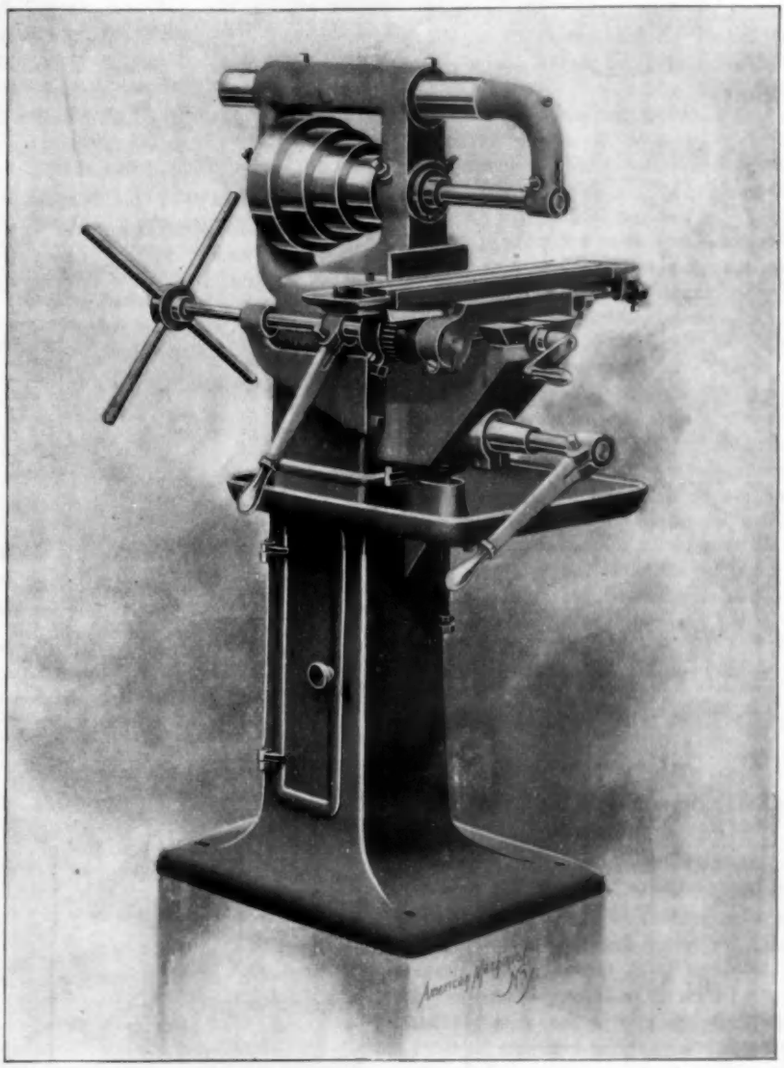
The reason why scoop-wheels have attained so much hold in the Lowlands is two-fold. In the first place a scoop-wheel could be made of wood, and so was easily repaired. In the second place many of the large Dutch wheels are run on a difference of head of about four feet only. On such low lifts is it not a fact that centrifugal pumps have a low efficiency? In such scoop-wheels as I have myself seen, the wheel runs close up to a curved apron of stone. The floats are not radial, but resemble the floats of a Poncelet water wheel, so that the water contained between the floats does not receive much lift above the surface of the upper pond, but slips readily off the rising float. As regards centrifugal pumps making an efficiency of 70 per cent, I hear that this is possible and ought to be exceeded, but seem unable to find anyone who can speak of its actual attainment.

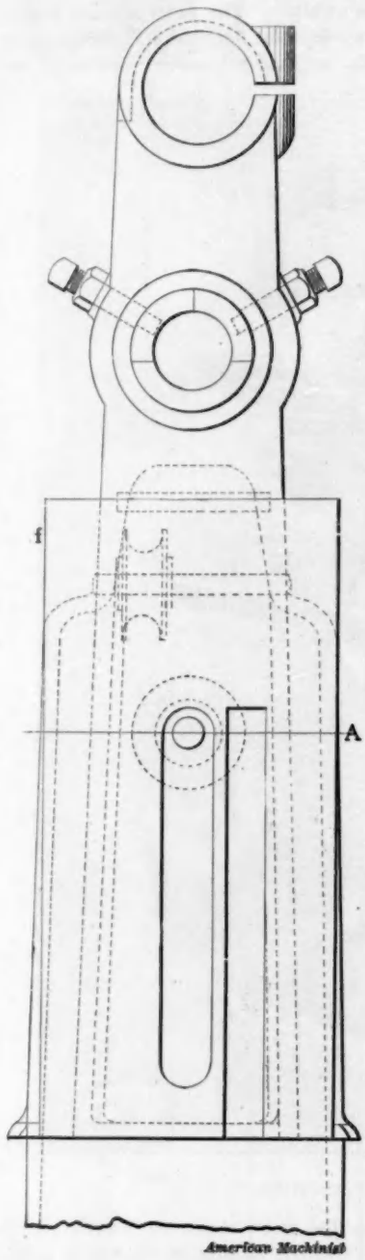


NEW HAND-FEED MILLING MACHINE.

New Hand-Feed Milling Machine.

The Fox Machine Company, of Grand Rapids, Mich., have brought out a plain milling machine, an engraving of which is shown herewith. As will be seen, the

machine conforms in a general way to the standard machines of its class, but it has a new arrangement for moving the platen, which arrangement is clearly indicated. The pinion shaft is carried back to the rear of the machine, where it carries a pilot-wheel, by which continuous motion can be given when desired, and there is also a lever which can be clamped



FRONT ELEVATION OF FRAME OF MILLING MACHINE.

to this shaft and used for short movements.

A novelty in the way of an adjustable box is introduced in this machine, which is shown by the section Fig. 2. The box consists of three parts, together forming a complete sleeve, and the two upper pieces are adjustable by the screws, as shown, so that in taking up lost motion it can be taken up in either lateral direction as well as vertically, it being the intention to have the edges of the segments in contact and pressed closely together by the screws.

It will be understood that all the motions of the knee and platen in this machine are effected by hand, and there is, inside the column, a counterbalancing arrangement by which the weight of knee and platen, etc., is nearly balanced, adding very much to the convenience and facility of handling. The machine has a hollow spindle with a No. 3 Morse taper hole. The distance from center of spindle to overhead arm is 4½ inches; working surface of the table, 5x18 inches; longitudinal movement of table, 9 inches; and of saddle on the knee, 5 inches.

Tube Making by Extrusion.

The production of metallic forms by the process of extrusion, or the causing the metal to flow out through a shaping die

FIG. 1. SAMPLES OF EXTRUDED METAL.

by means of enormous pressure, is by no means new, at least so far as lead pipe and rods of lead for bullets are concerned; but the employment of the process for the harder metals, principally alloys of copper, is quite recent. In 1896 the process and apparatus invented by Mr. Alexander Dick, of London, for the extrusion of brasses and bronzes, at temperatures at which they are plastic, were described in a paper read before the British Iron and Steel Institute. The process then described soon came into extensive employment, but was at first restricted to the production of solid bars only, although of as complex section as could well be desired. For the production of hollow sections the die must of course have a central shaping core, and this must be attached by ribs or wings to the portion of the die which shapes the exterior, these wings separating the metal as it flows by, and to finally emerge from the die in continuous circumferential section the metal must again be completely reunited. Mr. Dick later made the important discovery, the key to the complete solution of the difficulty, that copper and its alloys, when heated and plastic, may be separated and completely reunited if no air has access to the surfaces while separated, causing their oxidation. As a consequence of this discovery, metallic tubes of any section are now produced by extrusion as satisfactorily as the solid bars. A group of some of the simpler shapes produced is shown in Fig. 1, from an original photo.

It is to be remembered that the temperature at which the metal is worked is an important detail of the operation, the usual temperature for the copper alloys being about 1,000 degrees Fahr. Not only is the metal heated to this required temperature, but that portion of the apparatus which comes in contact with the metal must also be kept hot. The die which gives shape to the metal as it emerges from the press is heated to a cherry red before the run begins.

Fig. 2, also from an original photo, is a rear view of one of the presses employed. It consists principally of the cylinder or container and the hydraulic ram. The entire press is 16 feet long, 6

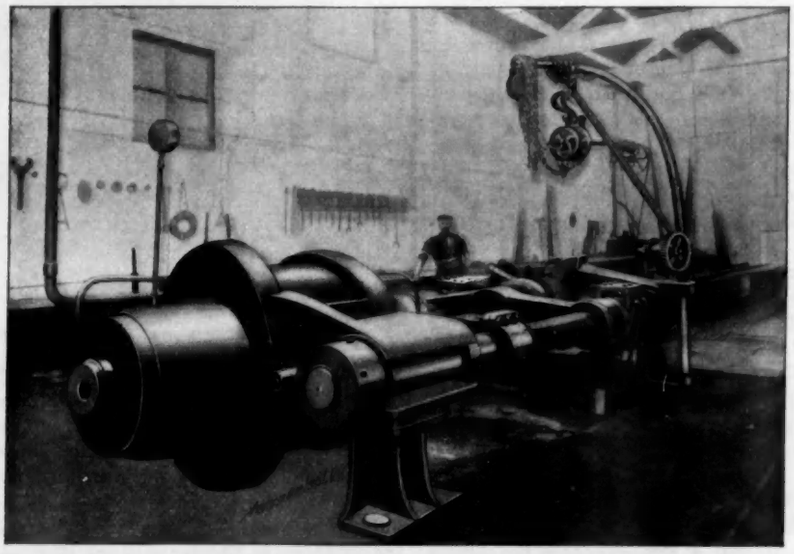


FIG. 2. AN EXTRUSION PRESS.

feet wide and 5 feet high. The container for the metal to be worked is 2 feet long and 2 feet in external diameter, and has a changeable inner liner of cast steel. The internal diameter of the liner is from 5 to 8 inches, according to the charge. The liner is enclosed within a series of cylinders of mild steel, spaced about ¾ inch apart, the annular spaces being filled with non-conducting material. The container is mounted on trunnions and fitted with worm gearing for turning it up for filling and then for bringing it to the horizontal position for the pressing.

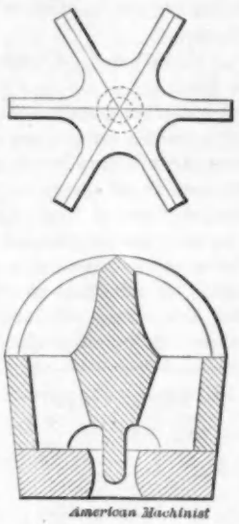


Fig. 3
EXTRUSION DIE.

The die fits into the outer end of the container. A typical die is shown in Fig. 3 (taken, with many of the details of this description, from "Engineering," London). This die is made of tungsten steel. The finished product emerges from the bottom of the die as it stands in the cut, although it is of course used horizontally. The central core or mandrel is attached to the outer portion of the die by six ribs, as shown. The metal is, of course, separated by the ribs, but as it flows on the strips of metal come together and are completely welded so that no seam and not the slightest local weakness is discoverable in the tube after it leaves the die. That is, none is discoverable after the process is in complete operation, although at the first emergence the end is as seen in Fig. 4, the air in the die at the beginning of the operation causing sufficient oxidation of the surfaces to prevent the union.

The die is fitted into a shouldered recess in a holder which is coned to seat into a hollow metal block, and this block is firmly held in position during the operation of pressing by a pair of hydraulically operated gripping jaws, the die holder and the gripping jaws being carried in a strong crosshead. The ram of the press is 20 inches diameter, working under a pressure of two tons per square inch. The ram has a prolongation of reduced diameter which forms the plunger of the container, the diameter varying to suit the internal diameter of the container then in use.

When a charge is to be pressed, the container, having been heated by gas with a Bunsen burner, stands in a vertical position, the die end downward and closed by a removable stopper. A billet of, say, delta metal, weighing about 160 pounds and heated to plasticity, is then placed within it. Upon this is laid a heated dished steel check-disk, less plastic and more rigid than the metal which is to be pressed, and when the pressure is applied this disk is expanded so that it completely fills the bore and prevents the back-flow of the metal. Upon this disk is laid, also heated, a loose block, a little smaller in diameter than the bore, so that it will not stick. The plunger also fits the bore quite loosely, and a tapered central boss on the end of it fits a recess on the back of the block, bringing them both concentric.

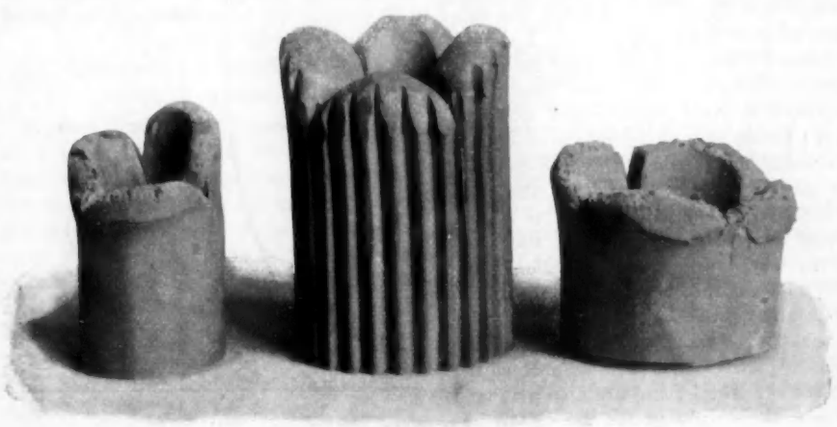


FIG. 4. THE FIRST ENDS OF THE RUN.

The block having been inserted, the container is brought into a horizontal position, the front stop-plate having been removed, and it is run up to the die block, which with the die has just been heated. The pumps are then started, and in about four minutes the charge is expelled through the die. The gripping jaws are then released, the ram continues its forward travel and pushes out the remaining metal, with the die and its holder, the check-disk and the loose block, leaving the container clear for the next charge. The tube or tubes (if small, several of them being made at once) are cut off from the stump or fag end of the charge, the die and holder are replaced by others, and the operations are then repeated.

The extrusion process not only cheaply produces the most difficult shapes, and many which before were impossible, but it also improves the quality and strength of the metal, as has been proved by numerous tests. Tests at Woolwich Arsenal upon extruded delta metal bars gave a tensile strength of 48 tons per square inch, with 32.5 per cent. elongation on 2 inches, against 38 tons and 20 per cent. for ordinary bar metal. In ordinary yellow metal the increase in tensile strength is 24 per cent., with proportionate increase in elongation. In some tests made in France with rolled yellow metal bars the tensile strength was 50.5 kilogrammes per square millimeter, with 18 per cent. elongation upon 10 centimeters; whilst extruded bars of the same metal gave 54.6 kilogrammes per square millimeter, with 25 per cent. elongation on 10 centimeters. Numerous other tests gave similar testimony. There are now nineteen extrusion presses in operation in Great Britain and on the continent, and three more are being installed.

Letters from Practical Men.

Amateur Lathe Work Near the Equator.

Editor American Machinist:

I was much taken with the method described by C. Z. D. of turning balls and fillets, in your issue of January 12, and lost no time in trying it on my lathe. I am the happy possessor of an American lathe, 6½-inch center, with compound rest. I took off the top slide, which swivels on a pin, and set the pin center in line with lathe centers. I then replaced the slide and locked the cross slide, as described by C. Z. D., and instantly found the answer to the question you ask, "Why the tool should be used behind the centers and the lathe run backward." It is because in no lathe that I have seen can the top slide be run far enough toward the front of the lathe to clear the tool post. As C. Z. D. says, "the size of the ball is limited only by the distance the tool post can be run past the swivel pin." This method of turning balls strikes me as a good wrinkle, but unfortunately it does not seem to have been contemplated by the maker of my lathe, for the tool post

can only be run far enough back to clear the center, so that I cannot turn a ball in the way suggested. Will any of your practical correspondents help me to another way?

I have a partiality for American tools, and have, for an amateur, quite a number, many of them picked up from the advertisement pages of the "American Machinist." My lathe is American, a rough but honestly built tool. I got the maker to put an "overhead" on it, run by an extra fly-wheel on the right hand of the treadle shaft, and it is such an all-round addition to the usefulness of the lathe that I am surprised that none of the American lathes I have seen advertised have it. Nearly all the good English lathes built for use by amateurs have an overhead. The scientific amateur, who has £50 to spend on a lathe, in England, would never think of buying one without an overhead. I am, therefore, surprised that your go-ahead machinists, who turn out such beautiful tools, do not place something tempting of the kind on the market. If such a tool is on the market already, all I can say is that it is not advertised, and it is a pity it is not. If a man has money enough to buy a shaper in addition to a good lathe, perhaps he is better to do so than to buy an English lathe with an overhead, but for one who is in that enviable position there are a hundred and more who have to be content with a lathe as their best tool. It is astonishing the jobs that can be done on a lathe with an overhead, that cannot be touched in an ordinary lathe. Apart from ornamental turning, there is gear cutting, slotting, fluting, drilling and many other operations that tax the ingenuity of an amateur with limited means and a small workshop. There is another side to the question that may appeal to your enterprising people. An overhead lathe produces an almost inexhaustible demand for tools and fixtures. Drilling spindles are wanted, division plates, fixtures to carry emery wheels and circular cutters, and a host of tools that would never be thought of if the overhead were not there. These run to a lot of money in a short time with an enthusiastic worker, and afford him endless pleasure. Anyone who doubts that there is a demand for the article has only to look at the English and French lathes that are made with overheads to have that doubt dispelled. I am, sir, one who has great pleasure in reading the "American Machinist." C. K. J.

Demerara, British Guiana.

[The "overhead" referred to by our correspondent is, of course, a horizontal shaft or drum, carried on standards above the lathe, and from which may be driven emery wheels, drill spindles, milling cutters, gear cutters and other supplementary devices mounted on the lathe carriage. To the amateur, whose one small lathe is his all in all, the utility of the "overhead" must be obvious, and the suggestion of our correspondent that American builders give the matter some attention may be well worth looking into. There is a considerable demand for amateur lathes abroad, and the business might be capable of development here.—Ed.]

Marking Size on Drills.

Editor American Machinist:

The letter from "Odd" in your issue of February 2 suggests a step in the right direction, and if it helps to turn the manufacturers of twist drills out of the "rut" of stamping size numbers right where they will get scrubbed off the first time the drill slips in the chuck it will be a blessing.

"W. R. G.'s" suggestion in issue of February 23 is good, but here is one that is different if not better. I always take drills when they first come in the tool room and file off a little flat spot about central in the shank of the drill and stamp the size on it. Then let the maker's stamp get scrubbed off. We can still see the number.

The flat spot does not impair the truth of the drill in any way as I can see, and since the chuck jaws cannot come in contact with it the number will last as long as the drill. It takes but a minute to do it, and in the long run it saves lots of time and bother. EZRA.

In Defense of "A Daring Invention."

Editor American Machinist:

Your heading "A Recent Daring Invention," in your issue of February 2, referring to my ball-bearing car truck, patented January 17, 1899, contains adverse criticism upon it, the premises of which are not well founded. Through the columns of your esteemed journal, I should be pleased if you will afford me the privilege of taking up the points mentioned, inasmuch as your article might work an injury to me otherwise, which of course you would not intend. The case containing the circulating channel for the balls is followed and preceded by a set of *car wheels with axles* precisely like the present car wheels except much smaller diameter, which do not bear the weight of the car in any degree, but guide the car over switches, frogs and open spaces in the track in precisely the same manner as the present car wheels, and are also arranged to take the weight of the car by an adjustment when the brake is applied, the weight of the car dropping again upon the line of ball bearings instead of the trucks when the brake is released. The distance of the case containing the balls from the track is represented by the distance of the present cow-catcher above the track, which is no experiment. Several of the prominent railroad experts of the country, to whom this device was submitted before patenting, passed favorably upon the absolute practicability of this device upon the present track, frogs, open joints and all connections now existing in common practice. The Patent Office has also granted this proposition as well as the other claims made in the patent of above date. The matter of snow, ice, slush or dust and dirt is also practically met in this ball-bearing car truck. In fact, a prominent system is already arranging for the equipment of a train with my ball-bearing car truck, which will fully demonstrate it.

LINCOLN C. CUMMINGS.

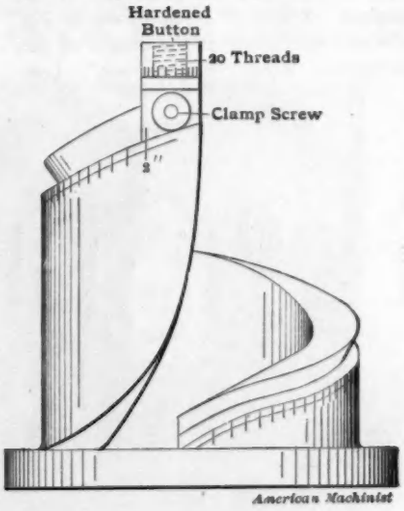
Portland, Me.

[The device here referred to, it will be remembered, provides for the use of balls directly upon the ordinary track rail for carrying the weight of the car. A long shoe attached to the car bears upon the balls, and as each ball is released by the advance of the car it traverses a channel which brings it to the front of the shoe on the other side of the car, and so on with both sides continuously.—Ed.]

A Hight Gage.

Editor American Machinist:

I submit to your readers another form of a gage. This idea grows out of the gage I sent you recently, that illustrates a gage on an inclined plane. This gage is a circular inclined plane, and consists of a base piece, having the top edge formed of a perfect helix or screw, and is a helix of one revolution and a fraction over. This edge I would make to be dovetailed, on one or both sides, and fitted to it a sliding block; this block to have a button



HIGHT GAGE.

on top and hardened. This button is fixed by a screw of twenty threads, and has on its outside edge fifty graduations, which gives an adjustment to one-thousandth of an inch. The block is held in position by a clamp screw. On the edge of the helix are graduations from zero to 2 inches, in sixteenths or any familiar number, and a witness mark is on the block. The bring-

ing of the block to the required hight is easy and quick, and the finer adjustment can be had by the button. This tool has some good points. It is not easily damaged, and is easily finished, and has few parts. It can be polished all over, and the most of the work done in the lathe. Perhaps it may suggest some useful idea to the craft, and perhaps be of use in this form. C. A. BURTON.

[The idea is worth presenting for its novelty, if for no other reason; but we cannot agree with Mr. Burton as to the tool so made not being easily injured. Its continued accuracy, after being once made so, will depend upon the care that is taken to avoid bruising or marring the surfaces on which the sliding block fits and moves, and as these are entirely exposed to any accidental injury, it would be difficult, we fear, to maintain accuracy. And in making such a tool some problems would arise that might be bothersome. It would be a very good lathe lead-screw indeed that would produce the helical surface shown with sufficient accuracy to stand the test of a micrometer caliper or other gage applied to the over-all distances from base to top of plug when in various positions determined by previously laid-out divisions equally spaced, and the only way we can see to be at all sure of reasonable accuracy would be to make the line upon the sliding block first, set the block by trial to the various positions required to give the corresponding hights, say for every half inch, mark these points on the body of the tool, and then space equally between them for the intermediate positions and measurements. The variations in distance between the various marks thus obtained would then give a very good idea of the degree of accuracy of that portion of the lead-screw used in producing the helical surface.—Ed.]

Concerning Cylinder Oil.

BY W. H. WAKEMAN.

A short time ago an engineer in charge of a large engine took off the cylinder head and found a quantity of the oil, where it had settled to the lowest part of the circle, and it was in just about the same condition as the oil in his tank, for it gave no indication that it had ever been used. He condemned the oil, claiming that it did not vaporize in the steam and so reach every part of the engine that the steam did, consequently it was not a first-class lubricant, and no more of it was wanted. The agent that sold him the oil asserted that the manufacturers of it expected their oils to give results similar to those reported here, for if an oil was so "used up" by coming into contact with the steam that none of it was left, it would be worthless. Furthermore, he stated that much more of the oil had been used than was necessary, for otherwise little or none would have been found in the bottom of the cylinder.

Now, as a rule, I have found that many claims set up by oil agents are extravagant enough to be termed "ghost stories," but in this case I am inclined to believe that the agent was right as far as his first claim is concerned, for I have used an oil so deficient in heat resisting qualities that when the inside of the cylinder was examined something was found there that much resembled "Saratoga chips" in an advanced state of dilapidation, although an excessive amount of the oil had been used in an ineffective effort to reduce the noise made by the piston and make it appear safe to stay in the engine room. This oil was, of course, promptly condemned and no more of it was used.

Here, then, are two cases, in one of which the oil was found in the cylinder unchanged, while in the other it was badly changed, and yet both were alike condemned. It appears as if this could not be considered right in both cases, and the oil that left only a coarse sediment behind it could not be used, while the so-called defect in the other kind was not discovered until the cylinder head was removed.

This brings to us a consideration of two claims set up in this connection, one of which is that if an oil is adapted to the use for which it was bought when it enters the steam it is at once vaporized, or in other words, is scattered throughout the whole body of the steam, saturating it with a good lubricant so that every part that is touched by the steam receives its proper share of oil. But this of necessity means also that all of the oil that goes to saturate the steam that does not come into direct contact with the cylinder walls, is wasted, for there certainly can be no advantage in saturating steam that passes through the center of a cylinder. If this theory is correct, then when an engine is heavily loaded it requires more oil than when it must carry only a light load, for it requires more to saturate a large than a small quantity of steam.

The claim of the above mentioned agent is that the oil he advocates is composed of materials which are not affected by the heat; therefore the valve seats and cylinder walls are to be treated as if they were ordinary cold journals, needing but very little oil, and, furthermore, no more is needed than with a light load.

As a rule, it is very natural for an engineer to increase the feed of cylinder oil when the load is increased, especially if it causes the engine to "grunt" or "groan." I once had charge of an engine with Corliss valves, the stems of which were badly worn, so that when the load was increased, so much more noise was in evidence that to stay in the engine room was more of a duty than a pleasure. I admit that more cylinder oil did not remove the evil; but when it is so plain that some action is required, and about the only thing an engineer can do is to use more oil, he usually does it, and I was no exception to the rule. In another case I found that a moderate amount of an excellent oil, say three drops per minute, would not prevent a squeak in the valves, although it looked almost as good as new after passing through the cylinder. The addition of a small quantity of lard oil reduced the size of the drops about one-half, and caused the squeak to disappear. This showed that while the oil was a standard article, it was not suited to that engine. If the steam had been thoroughly saturated with it, then it would have reached the part that was squeaking, but as it was it remained in its natural state, and so passed out without fulfilling its mission until the lard oil was added, when the trouble disappeared.

If there is any business in which the competition exceeds that which the dealer in cylinder oil must meet, I am not informed of it; but still there is at least one company (and perhaps more) who maintain a fair price for their goods, and who claim to meet all competition by furnishing an oil that will last much longer than any other in the market. I have no desire to combat their ideas so far as I understand them, for they demonstrate that one drop of their oil per minute is sufficient for almost any engine; but there must be a limit to the reduction of cylinder oil feed, or, in other words, a time when it will not pay to feed less oil, because it requires too much of coal or something else to be profitable, and in my opinion that limit is reached before the valves or the piston begin to cut their seats.

The following incident has some bearing on the case. I have a boiler-feed pump that belongs to a tribe that is not highly esteemed by many engineers in this vicinity, because they cannot make them run continuously at a slow speed, but up to a few days ago I had never had trouble with it. I have a good sight-feed lubricator on my engine, and also one on my pump; but wishing to have a hand-pump lubricator on my engine for emergencies, I procured one, but before fitting it up in its permanent place, I put it on the boiler feeder in place of the sight-feed lubricator, for trial. As a matter of course it was used just as similar devices for lubricating pump cylinders are used, for when I thought of it I gave it a charge, and when other duties were pressing I let it take care of itself. In a few days my pump would not run steadily, but persisted in stopping until I had pumped enough oil into its steam cylinder to run it two days if fed with the sight-feed lubricator. This was convincing proof to me that many pumps are ruined by oiling their cylinders spasmodically instead of steadily.

Letting it run for about an hour after giving it this extra dose of oil, I timed it and found it made 18 strokes per minute. Raising the oil-pump lever and giving it one stroke, the speed of the pump was increased to 19 strokes per minute, and in

Fig. 5

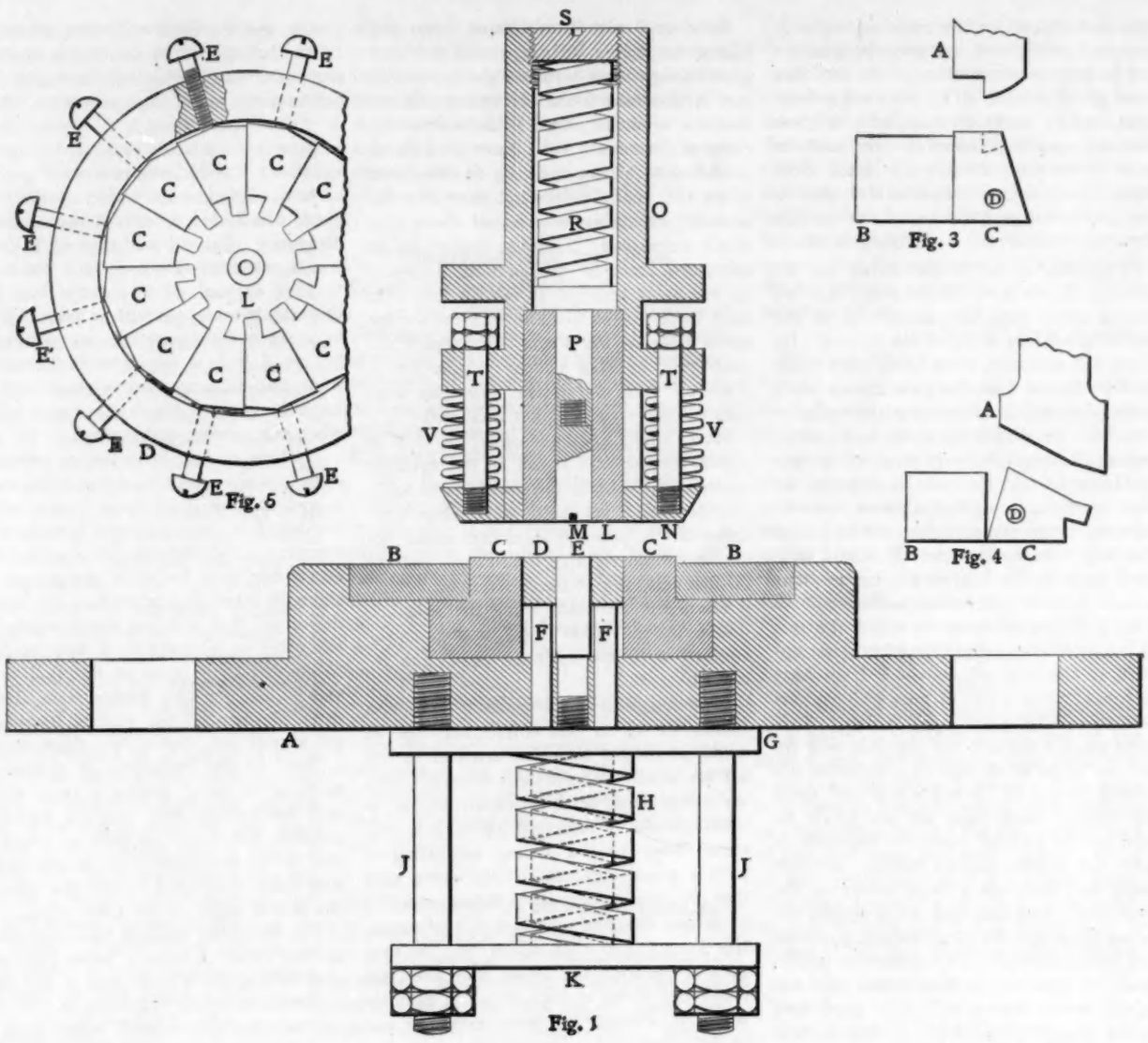


Fig. 1

Fig. 3

Fig. 4

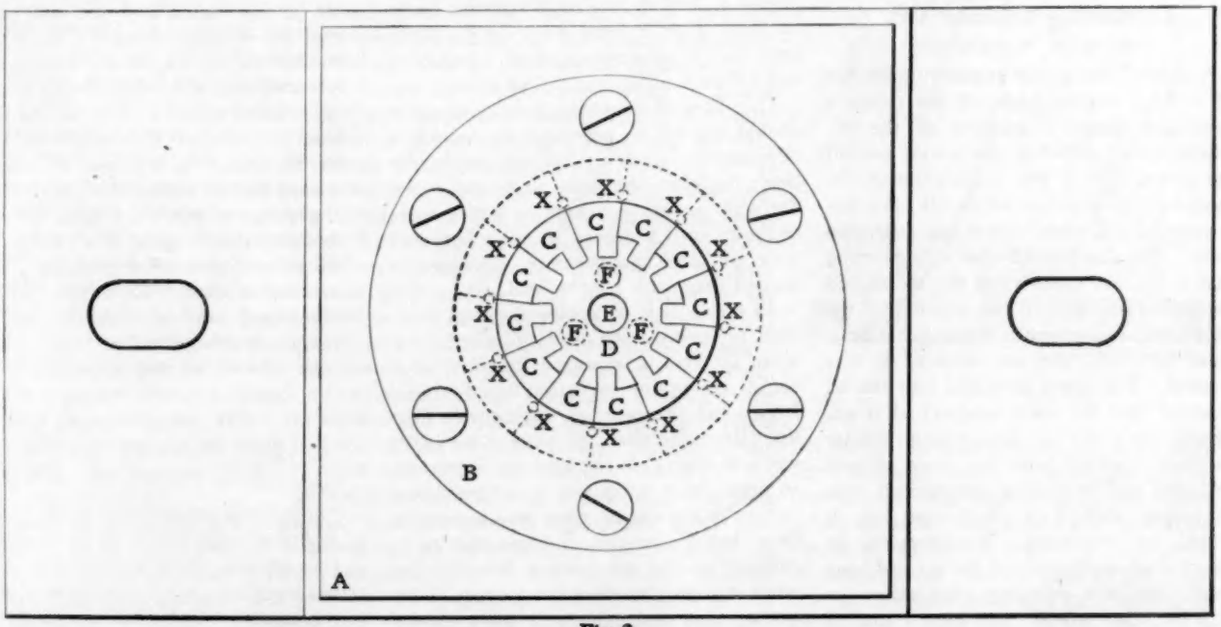


Fig. 2

A COMPOUND DIE AND DETAILS.

this way it was given 10 strokes more, and carefully timed after each stroke. The numbers of strokes per minute of the boiler feeder were as follows: 21, 23, 25, 25, 25, 26, 27, 25, 27 and 28. During this time the throttle valve was not disturbed, and the steam pressure did not vary more than 2 pounds.

Here, then, is a clear case of the duty of a pump being increased more than 50 per cent. by the use of about half a pint of cylinder oil, although it was in no danger of being damaged for lack of lubrication when the test was begun. This seems to be good evidence to show that an engine may be run with such a scant supply of cylinder oil, that it will require much more steam than if a reasonable amount of oil is furnished, although the valve seats and cylinder are not cut or grooved by the extra friction.

Making a Compound Die.

BY W. A. WARMAN.

It may interest a few of the readers of the "American Machinist" to know a method of making compound dies, or this article may incite some others to suggest a better one. The die illustrated is for cutting an armature disk 1½ inches diameter. Accurate spacing, accuracy in the size of slots, flatness and freedom from burrs are the requisites. We find that these are more easily secured by making up the die of segments as shown in Fig. 2. Figs. 1 and 2 show section of punch and die, and plan of die, respectively. This part I think is sufficiently clear from the sketches.

In making these dies we first mill the punch and "push-out," *D*, Figs. 1 and 2, to shape. If you have not unlimited confidence in your mill and dividing head, it will be safest to mill opposite grooves at the same setting—that is, cut top and bottom without shifting, holding the piece in the chuck.

For the segments, make a templet and make the fly-cutters *A A*, Figs. 3 and 4. Plane the steel for segments to the shape *c*, Fig. 3. Bolt the cast-iron piece *B*, Fig. 3, to the mill table and true it up with a good sharp side cutter.

Secure *c*, Fig. 3, in the position shown, clamping with straps fitting the holes *D*. After milling the first shape proceed as illustrated in Fig. 4. Make the cast-iron ring *D*, Fig. 5, ½-inch thick, and tap for screws as shown. Plane a piece for segments to shape shown in Fig. 5; cut into lengths for segments, put the punch *L* on a mandrel, and secure the segments in position, with the ring *D* and screws *E*, and turn one end to size. Put the die block *A*, Fig. 1, on the face plate and bore out to fit the ends of segments already turned, and turn out to fit the ring *B*. Drive the mandrel out of the punch *L*, and fit a shouldered brass or copper plug into the end of L. Drive segments and punch into *A*, and finish turning and drive segments to place. Drill holes and put in the twelve pins *x*, Fig. 2. Fit ring *B* and put in screws.

Now you can drive out the punch, provided you did not forget to put in the brass plug before you drove it in. The push-out *M*, Fig. 1, is screwed into the spring-actuated plunger *P*, so that it may be taken out for convenience in setting. The push-out *D* is removed, and is simply dropped into place on the pins *F, F, F*, after setting. By pulling up the bolts *T, T*, Fig. 1, with the nuts, the stripper is raised to allow the punch to enter the die in the setting.

H and *R* are springs of flat steel tempered. There are eight of the springs *V*. *S* is a screw plug for adjusting the tension on spring *R*. The die should be hardened and drawn just enough to start the color. The punch may be drawn to a medium straw color. The push-out *D* should be case-hardened, if made of soft steel.

We are using a tire steel for strippers when there is not too much work to be done on them. It is highly satisfactory in most respects, sufficiently hard without tempering, stiff and tough; but, like most good things, has its faults, the most serious one being that it is hard to work.

The Fate of a Genius.

"Some men that have average or more than average intelligence in certain directions seem to lack even the protection of instinct in other directions. You've heard the old story of the man who got on the wrong side of the saw while trimming a tree, and never realized his error till he had dropped 20 feet to hard ground? Well, sir, I have a true incident to match it."

"Go ahead," was urged upon the philosopher, who is one of Detroit's big ice dealers.

"A chap came to me early in the season and wanted me to invest in an ice-cutting machine he had invented. He tried to tell me all about it, but I simply told him to get his machine out on the ice and put it to work as soon as we commenced operations. If it would do what he claimed for it, we would have no difficulty in coming to terms. I happened to be on the field the morning of his appearance, but was too busy superintending affairs to give him or his device any special attention.

"Suddenly there was a great yelling, spluttering and calling for help. We fished my inventive friend out of the water, half-drowned and half-frozen. His machine had started, under the ice, for a journey toward Niagara Falls."

"How did the thing happen?"

"Nothing accidental about it. The machine was made to cut circular pieces of ice. The whole trouble with the thing was that the genius and his machine had to stand in the center of the fated circle while working."—"Detroit Free Press."

Seasoning Wood by Electricity.

A model plant for seasoning wood by means of electricity is now in operation at Messrs. Johnson & Phillips' electrical works, near Charlton Junction, the system used being the Nodon-Bretonneau. According to the "Times," the timber is placed in a large tank and immersed, all but an inch or two, in a solution containing 10 per cent. of borax, 5 of rosin, and ¼ of carbonate of soda. The lead plate upon which it rests is connected to the positive pole of a dynamo, and the negative pole being attached to a similar plate arranged on its upper surface so as to give good electrical contact, the circuit is completed through the wood. Under the influence of the current the sap appears to rise to the surface of the bath, while the aseptic borax and rosin solution takes its place in the pores of the wood. This part of the process requires from five to eight hours for its completion, and then the wood is removed and dried either by artificial or natural means. In the latter case a fortnight's exposure in summer weather is said to render it as well seasoned as storage in the usual way for five years. The current employed has a potential of 110 volts, the consumption of energy being about one kilowatt per hour for each cubic meter of timber, and the greener the wood the better, because its electrical resistance is less. The liquid in the bath is kept at a temperature of from 90 to 100 degrees Fahr. Those who are introducing the process into this country from France do not profess to be able to give a complete explanation of its *rationale*, though they describe it generally as a case of electro-capillary attraction; but they claim that its results are satisfactory, however surprising they may seem. They even state that some woods, such as the "maritime pine" of the south coast of France, which cannot now be properly dried, will, after their treatment, be found useful and serviceable for practical purposes.—"The Mechanical Engineer."

Mr. J. C. Richards, 768 West Lexington street, Baltimore, Md., writes us that he would like to obtain the following numbers of the "American Machinist" in order to complete his file: January 3, 10, 17, 24 and 31, February 7, 14 and November 21, 1895; May 14, 1896; January 14, March 18, October 28, 1897, and October 27, November 3, 10, 1898, and that he would be glad to exchange the following issues of 1894 for these: March 29, April 26, May 10, 17, 24, 31, June 7, 14 and October 18.

Regarding the book recently mentioned, called "File Filosophy," and issued by the Nicholson File Company, Providence, R. I., this company writes us that a copy of the book will be sent to any reader of the "American Machinist" upon request, free of charge.

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The Premium Plan.

A recent editorial note in these columns in which the premium plan was referred to, has brought so many inquiries for information regarding the plan, from both sides of the Atlantic, that we feel the article on another page setting forth the actual workings of the plan to be decidedly timely. These inquiries have for the most part shown so little understanding of the real nature of the plan that it has been thought best to explain it again in detail, especially as the stock of pamphlet copies of the original paper read before the American Society of Mechanical Engineers is now exhausted, in consequence of which many requests for this paper have had to be refused.

In the writing of this article all considerations of sentiment have been ruled out, and the effort has been made to view it from a hard and fast dollars and cents standpoint. This is not to be understood as meaning that the author has no feelings of the opposite kind, but as proceeding from a well-grounded conviction that the course adopted is the only one which will command the attention of those who must be interested if progress with the system is to result. It is as certain as anything can be that the plan will be adopted only in the expectation that reduced costs will follow, and that, once adopted, its use will be continued only because of its results in reducing costs. While, therefore, much might be said in its favor from an ethical standpoint, based on the fact that it enables an employer to increase his workmen's wages, this has been touched upon incidentally only—the offer of such increase being made the means whereby the cost of the work is reduced, and the reduction of cost being given as the argument on which its adoption is urged.

A similar consideration has prevailed in the views expressed regarding the rate of premium to be paid. We should be glad indeed if the conditions of competition and of human nature which surround business enterprises were such that higher premium rates than those named could be advocated; but again, we are satisfied that the course advocated will prove in the end the best for all concerned. It must be remembered that the average superintendent does not have a free hand in these matters, that even though higher rates than those advocated were known by him to be justified by results, his work is, in the end, subject to review by a business manager or a Board of Directors, who usually know about as much of the conditions of factory production as they do of the back side of the moon. Such men, in the innocence of their hearts and the profundity of their ignorance, often consider that a given machine should produce a given output—"If one man won't do it, another will, you know"—and it is inevitable that a high rate of premium, even though producing cheaper work than was ever known before, will in many cases be brought under review by such men, and the whole system be condemned in consequence. From such considerations as these we believe that the moderate premiums recommended will in the end produce the best, because the most permanent, results; though we have no doubt whatever that the importance of increased output—especially in times like these when, in many industries, sales are limited only by output—is such as to justify far higher rates than those advocated.

One of the standing objections to the system is that under it the rates may be cut as under piece work, and hence it seems to be as objectionable from this standpoint as piece work. The answer is that while the system does not make rate cutting impossible, it does make it unnecessary, for under piece work the cutting of the rates is a necessity which the fairest-minded employer in the world encounters sooner or later. Under piece work the piece price and the piece cost are yoked together, and the piece cost cannot be reduced to meet reduced selling prices without cutting the piece price. Under the premium plan there is no piece price, but the piece cost and the premium earnings are so yoked together that an increase of earnings necessarily goes with a reduction of cost, and as time goes on and production increases, the employer finds his costs going down without cutting the rates. It is not pretended that the system will overcome cupidity and avarice, get blood from stones, or make philanthropists of skin-flints, but it does overcome the necessity for rate cutting, which is inherent in the piece-work system, and it thus permits fair dealing, which piecework, in most lines of work, prohibits.

Much has been said in the article on the importance of not cutting the premiums, or putting any limit to the workman's earnings, except that set by his own capacity to produce. Of two employers, one of whom set such a limit after a certain amount of progress, while the other did not, it is clear to anyone who has grasped the principle of the system, that with the first, progress in reducing costs would stop when the limit was set, while with the second, progress would continue. The foundation fact for all to grasp is that increased earnings can only be made by a reduction in cost.

The chief merit of the system, in fact, is that it is in accordance with the strictest principles of economics. Were it otherwise it could not stand. Its sole aim from the employers' standpoint is to produce work as cheaply as possible. The workman gives a full equivalent for every extra dollar paid him—a fuller equivalent in fact for the premium portion of his earnings than for the daily wages portion—and a partnership interest in efficient production is secured without any features savoring of charity, patronage, or paternalism. The system does not make the employee a ward or protegé of the employer, but preserves his independence and his manhood, while giving him an opportunity to profit by his industry. We commend this record of experience to employers and employees alike—both of which classes are represented so largely in our circle of readers. We confess that we should have been better pleased had the results shown in the tables been less favorable. As they are they seem to border on the impossible, while were they less favorable they would be more readily accepted. Facts are facts, however, and surprising as are the results, they are the true records of experience. We ask employers to study the columns giving the records of increased output and reduced cost, while to employees we call attention to the record of increased earnings, and we ask both if they would not like to repeat the experiences here shown. Is it

not plain to both that this system offers a means for reconciling differences and introducing a spirit of co-operation which is desired by all but realized by few? Is it not plain that here is the road to the goals which both parties have in view—high wages per day for the workman and low wages per piece for the employer?

On another page of this issue we publish an article under the heading of "The Management of Ordnance Factories," which shows that in England a question sometimes arises which has at times been discussed here also, though, we think, not so much nor so urgently as there. It will appear from the article referred to that in other countries as well as here men will argue for the side in which they are, or in which they may imagine themselves to be, interested, and will suppress important facts and arguments on the other side; that even a great paper such as the "Times" of London will go into a discussion of this kind and take an entirely one-sided view of it and permit its influence to be used on what is demonstrably the wrong side of the question. This was presumably done in this case from pure ignorance—that is to say, from an inability to understand the nature of the question under discussion, and from a too great readiness to accept the views of army officers who may have had the ear of its editor. There can be no more doubt that the proper person to make guns is a gunmaker than that a shovel manufacturer is a better person to make shovels than a ditch digger can be, or that a skilled mechanic can manufacture typewriters to better advantage than a typewriter girl could ever hope to; yet the arguments advanced by British army officers and by the "Times" have evidently been equivalent to an effort to disprove these self-evident facts.

Many of us are inclined to think perhaps that it is in the shops and factories only that the employees are apt to be very badly treated, but, according to the latest advices, the golf clubs of Brooklyn, which are organized for the purpose of affording a good time to certain people, have advanced considerably further than any factories we know of. They have made rules for the regulation of the small boys whose task it is to carry the various sticks around the field, keep track of the balls, etc., these boys being called "caddies." It seems that the caddies of Brooklyn have been doing things not approved of by their employers. And to meet this difficulty the golf clubs have agreed to put into practice certain rules which cover the amount of remuneration each caddy is to receive, and every caddy must wear a badge bearing a number, and if any caddy is discharged, or if he quits work in any club, he cannot be employed by any other club unless re-instated by the one in which he formerly worked. And thus we see the full-fledged black list employed to take advantage of and to impose upon helpless boys from ten to fourteen years of age, who for one reason or another are compelled to be self-supporting.

No machinist who is now or who may intend in the future to go into business for himself can afford to miss reading the article by Mr. Blanchard on another page of this issue. All the experience of all who have conducted such a business points to the wisdom of every position taken, and it is safe to say that any departure from the principles there laid down should be for very exceptional reasons, and will be attended with risks that a shop owner ought not to take.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(22) S. H., West New Brighton, Staten Island, N. Y., asks: In using a 1¼-inch bolt to draw in a bushing, what pressure can be applied by the bolt as compared with a hydraulic press for the same purpose? A.—The probable breaking strain for a 1¼-inch bolt we find in Kent to be 39,000 pounds. The bolt will do well if it puts one-half of this strain, or, say, 10 tons, upon the bushing.

(23) W. K. H., Kansas City, Mo., asks: What kind of acid can I use to eat tool steel? I want to use it to relieve the cutting dies of a pipe-threading machine. A.—The threads should be thoroughly cleaned and the parts which are not to be touched by the acid should be protected by wax. This may be done by warming the dies sufficiently to melt the wax, and then pressing the points of the teeth into a cake of wax; or the teeth may be entirely covered by dipping into melted wax, and the wax may then be scraped away from the surfaces to which the acid is to be applied. Use a mixture of equal parts nitric acid and muriatic acid, applying with a feather, and when the steel is supposed to be sufficiently eaten, wash in water, which stops the process. It would be well to experiment with some unimportant piece of similar steel first. Would be glad to receive report of experience.

(24) J. L. S., New York City, asks: How many gallons of water per hour at 50 pounds pressure would flow through circular openings ⅜ inch and 5-16 inch diameter, respectively? A.—Clark's general formula for this case is:

$$Q = 5a\sqrt{h}$$

in which Q is the volume discharged in cubic feet per second, a the area of the opening in square feet, and h the head or hight in feet which the water freely falls. As a hight of water of one foot gives a pressure of .434 pound, the hight represented by 50 pounds pressure is 50 ÷ .434 = 115 feet, and the square root of this is 10.72. The area of a ⅜-inch circle is .11045 of a square inch, or .11045 ÷ 144 = .000767 of a square foot, and the area of the 5-16-inch hole is .0767 ÷ 144 = .0005326 of a square foot. There are 6.23 gallons in a cubic foot. The discharge of the ⅜-inch hole, therefore, in gallons per hour will be: 5 × .000767 × 10.72 × 6.23 × 60 × 60 = 922; and the discharge of the 5-16-inch hole will be 5 × .0005326 × 10.72 × 6.23 × 60 × 60 = 640.

Personal.

Mr. E. P. Bullard, of Bridgeport, Conn., has returned home after a business trip of several months in Europe.

Mr. George T. Montgomery, of Montgomery & Co., Fulton street, New York, sailed on the 4th inst. per steamship Umbria for a six weeks' visit to Europe.

Mr. Benj. Middleditch, recently superintendent of the Detroit (Mich.) Heating & Lighting Company, is about to start a machine shop to do jobbing work and build special machinery.

Mr. F. G. Echols, who has been in charge of the small tool department of the Pratt & Whitney factory at Hartford, Conn., has been appointed to take charge of the sales department of the entire business, and Mr. Frank C. Pratt will, we understand, go abroad as foreign representative of the company.

Obituary.

Henry F. Woodmancy, a foreman machinist of the Whitin Machine Company, Whitinsville, R. I., died February 20.

Charles W. Cronk, a veteran engineer of the volunteer army, who served with distinction throughout the civil war, died in Newark, N. J., February 16. After the war he became superintendent of marine construction at the Washington Iron Works, Newburg, N. Y., and later was in the employ of the Singer Manufacturing Company, at Elizabeth, N. J. For the last few years he was in the construction and repairing department, at Newark, of the Pennsylvania Railroad.

Inquiries for Machinery.

(95) From England for full plant of special machinery for the manufacture of hand taps to the Whitworth standard.

(96) From England for complete plant for manufacturing fret saw blades, including machines for manufacturing and sharpening cutters, automatic tempering furnaces, and machinery for making cases to hold saws when finished.

(97) From Italy for names and addresses of manufacturers of reliable calculating machines.

(98) From England for a complete outfit of machines for coating with emulsion photographic papers and plates, also an emulsion mixer, and machine for cutting the paper.

Commercial Review.

NEW YORK, SATURDAY EVENING,
March 4, 1899.

ENGINES, BOILERS AND PUMPS.

The salient feature of the present market for both boilers and engines is a higher range of prices. Within a month past a pretty wide-spread advance has taken place in the quotations on engines. In some cases it antedates the month of February, in others it has been so gradual that no time limit can be assigned to it, and indeed in many others it is yet to come; but the critical period appears recently to have been passed. The market has undergone a betterment of about 10 per cent. in engine prices. One New England company has, since the first of the year, made two advances upon the prices of its engines, the latest one bringing the increase up to 17½ per cent. A large company engaged in the manufacture of hoisting engines has not yet advanced prices, but, we understand, has the matter under serious consideration. Some parties deny that when engine sellers are chasing actual customers, their higher prices are apparent. Perhaps, however, the strength of the market since the recent advances has not yet had time to be thoroughly tested.

The increase in boiler prices has been more nearly universal, and it has been greater, amounting to about 20 per cent. The increased cost of plates and tubes, some 40 or 50 per cent., rendered such a move on the part of manufacturers imperative. Whether the advance in the finished article, besides offsetting the increase in cost of the material nets a large profit of the boiler manufacturer, is disputed. Cases undoubtedly differ. Moreover, the steel market is so fickle that boiler makers hardly know where they stand. But the best opinion seems to be that the advances have been made with an allowance to the manufacturer of some increase in profit with the augmented value of the article he constructs.

Coupled with a rising steel market is difficulty in obtaining early deliveries. A leading local steel firm, for example, has just named two months and a half as the earliest time for delivery to a manufacturer, of a lot of boiler steel. In view of the urgent demand for boilers by industrial establishments, a shortage in them is predicted. Boiler makers are embarrassed also in estimating upon future work by the steel market's mobility. "You can't turn around twice but there is some new advance," they say.

"Never in five years," says the manager of a local boiler office, "has there been a time when we have been so hopelessly at sea as now. Prices of steel are rushing up constantly. We have a fair amount of material on hand in our shops and the demand surpasses our capacity to fill it. What policy shall we adopt? A conservative policy, yes, but how conservative? In the past few years I think it has been the makers of cheap boilers who have profited. Now there is opportunity for the better class of goods."

Grave fears are entertained by one of the most observing sellers of boilers whom we know that the advances will hurt export trade. He has noticed some injury thereto already. "In competition with English, German and Belgian boilers," says he, "at the same price ours have the preference. But their popularity will not stand a greatly increased cost."

There has been a more or less general strengthening of quotations on pumps since the advance in material. It amounts to 5 or 10 per cent in cases of which we have heard in this market.

It is suggested that the higher price of brass may have something to do with the strength of the steel market, because for economy's sake steel is now employed in some places where brass formerly was. A manufacturer of large quantities of small brass stamped goods, such as glove buttons, at New Haven, Conn., remarks that his customers are now ordering black steel articles instead, because of the cost of the other material. We wonder how many glove buttons it would take to affect the market for billets.

ENGINE AND PUMP COMBINATIONS.

A new consolidation that is in the wind is one among high-speed engine manufacturers. This is not the same as the attempted combination of the re-organized Corliss, the American Wheelock and other companies, mentioned in these columns a few weeks ago. As yet it has been discussed among only a few engine concerns and chiefly within two weeks past. We have unequivocal information, however, from one of its prime movers that an attempt is to be made to interest the leading high-speed engine manufacturers in the project.

Rumor predicts the organization of a trust by the leading pump manufacturing companies doing business in this district. By parties in the engine business, upon whose candor we rely, it is affirmed that the formation of a pump combination seems to be approaching consummation. It is even stated what banking and legal firms have the financeering of the new organization in charge, though as to their identity there is not entire harmony in the reports. It is rumored that some of the parties to the consolidation have already deposited securities with a certain trust company. The name is mentioned of a man who will be treasurer of the trust. With a view to confirming or contradicting these reports, we have made inquiries of responsible representatives of some pump companies involved. One of them admitted that there was talk of consolidation, but stated that there had been for six years. He said that consolidation was probably nearer than it had been, but he intended that we should take this as a vague aphorism, and denied that within his knowledge the early accomplishment of such an end was by any means certain. The representative of another company stated with apparently no attempt at evasion that he did not believe the consolidation, if indeed in process of formation, had got as far as the underwriting. He said that when this was desired it could be done without difficulty several times over. The president of one of the largest pump companies denied knowledge upon the subject of consolidation in a manner not redolent with a spirit of ingenuousness. These statements do not convincingly discredit the consolidation reports.

Sales and inquiry for both engines and boilers during the month of February were exceedingly active. The usual inequalities in the comparisons of February's with January's trade among the sellers render it impossible to be sure which was the better month. Engines and boilers are not like groceries and spools of cotton. They fall in spots. Because a meteorite dropped into a certain field last year and none struck there this year it is hardly fair to say that astronomical matters in general are duller now than then. In some local market fields bigger orders fell in January, in others in February.

"Not in the five years of my experience in the engine business in New York," says the representative of a well-known Corliss engine company, "have I seen it so prosperous as it is now. In this office during February we turned down orders for over $100,000 worth of stuff because we couldn't get it from the factory."

In our report last week upon machinists' supplies the fact was brought out that Southern industries are attaining a highly prosperous condition, while the New England market is following the forward movement of business afar off. Inquiry made by us among engine and boiler sellers this week brings confirmation of the high esteem in which Southern activity is held. That of the Down Eastern States is generally acknowledged to be indifferent, but to this there are some exceptions. The Harrisburg Foundry & Machine Works has received some large orders from Eastern mills, and at the office of one of the principal Corliss engine companies is reported good inquiry from that district.

The Ball & Wood Engine Company is very busy.

The Lidgerwood Manufacturing Company is receiving a remarkably large volume of orders this year in spite of the fact that the winter months are expected to be comparatively quiet. February showed improvement even over January. The works are hard rushed. Among the contracts on hand allusion may be made to six ballast unloaders for

various railroads, and also to logging machinery.

The Hooven, Owens & Rentschler Company's works are running 23½ hours per day with all the men for whom room can be found in shops and foundry.

The Buffalo Forge Company has lately been in the market for new tools to be added to its equipment, the works being hard driven. The company is understood to have on hand orders for nearly forty engines. Some of those of particular interest are two 15x15-inch self-oiling engines, direct connected to fans 14 feet in diameter by 7 feet wide, for smelting works of the Compañia Metalurgica Mexicana, San Luis Potosi, Mexico; two marine type engines for lighting purposes on board cable ships which are fitting out for Manila; a heating and ventilating apparatus for the Ashwell & Nesbit Company, Victoria Foundry, Leicester, England; and some Canadian orders, viz., three fans with direct-connected engines for forced draft, sold to the Standard Oil Company for works of the Bushnell Company, Ltd., at Sarnia, Ont., and a dry kiln and heating apparatus with a down draft and forge outfit for the Ottawa, Arnpryor & Parry Sound Railway Company.

At a town up the Hudson is in contemplation a brick making plant, which is expected to be one of the finest in the world, and for which 2,200 horse-power of engines in three units will be required. There will be more or less electrical work in the equipment.

The Michigan Alkali Company has ordered of McIntosh, Seymour & Co. a 450 horse-power horizontal tandem-compound belted engine.

The chief of an active local engineering firm who has been traveling in Porto Rico writes home to the effect that while there is not much engineering work there immediately in sight the prospects are for considerable of it later.

A Pennsylvania company locally represented has sold a 150 horse-power compound engine and three or four boilers for mining purposes in Mexico.

An official of a company manufacturing high-speed engines of both the automatic and the plain slide valve type states that the sales of the latter and cheaper class have increased more rapidly than those of the former. We question whether this experience is indicative of general conditions.

An Ohio boiler company is reported to have closed up contracts for 90,000 horse-power of boilers during the first two months of this year. The works are running on double time.

The New Era Iron Works Company, Dayton, Ohio, reports an unusual demand for the New Era gas and gasoline engines, especially in the large sizes. They build engines on order only and have now in process of erection in their shops one 125 horse-power, one 80 horse-power, two 60 horse-power, two 50 horse-power, two 40 horse-power, besides a large number of smaller sizes. They state that they are building the largest single-cylinder gas engine in the United States, and are over sixty days behind their orders.

The Snow Steam Pump Works have been awarded a contract for a 15,000,000-gallon triple expansion pumping engine for the Calumet and Hecla mines, to be operated with 185 pounds of steam.

CHICAGO MACHINERY MARKET.

Asked about the condition of trade during the past month, the electrical engineer or supply house will reply, in all probability, that it is 50 per cent. better than a month ago. That is the conclusion reached after a number of inquiries of that nature had been propounded. Activity in demand for motors and generators is mainly seen among manufacturing plants, which are changing their location, whether because more room is required or because another site is more advantageous, or for whatever reason. The number of plants that are thus moving from one place to another is quite large. The electrical men have been doing missionary work among them, and it is said that in a majority of instances the manufacturers have been installing electrical power. Preparatory to this change in power it has not been uncommon for the manufacturer, at the solicitation of the electrical company, to install a single motor of small or medium capacity in order that the advantages of the new system might be made familiar to the user, and the way thus made easy for negotiations a little later, when a change in location made a substitution possible without great loss to old equipment.

Some makers of electrical supplies report that prices during the past month have advanced from 5 to 10 per cent. Other manufacturers say they have not yet marked up prices, but that they expect advices from headquarters almost any day to make the advance. From no quarter is heard the complaint that values are now excessively high. One peculiar feature of the trade here is that quite a number of inquiries are being received from territory that is beyond the legitimate field of this center. They come even from New England. One explanation of this widening range of the Chicago market is that values are lower here proportionately than in other parts of the country, and one seller ventured the suggestion, which is not

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Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting, Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.,R.I. Send for index sheet.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—One 30-inch Shellenbach pulley lathe, made by Henley machine Tool Works; in very best condition. Curtis & Co., Mfg. Co., St. Louis, Mo.

Wanted—Machinist to manufacture gasoline engine, light weight, 2 horse-power; works perfectly for motor tricycles. Box 130, AMERICAN MACHINIST.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Best workmanship; reasonable charges; watch, clock and other light machinery; send for samples of punch and die work. Waltham Machine Works, Waltham, Mass.

Machinery Wanted—Manufacturers of steam pipe covering are in the market to buy hydraulic machinery or other kinds for the manufacture of molded coverings. Address Box 136, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

For Sale—Back numbers of the "American Machinist," years 1883 to 1898, inclusive; all in first-class condition and complete, except year 1884, which is short Nos. 35, 36, 38, 40, 41, 42, 43, 44, 46, 48, 49, 50, 51, 52; year 1885 short No. 35, and year 1886 short No. 36. Address Box 154, AMER. MACHINIST.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Experienced draftsman desires to change. Box 125, AMERICAN MACHINIST.

Draftsman, engine, general machine, for New York. Box 142, AMERICAN MACHINIST.

First-class toolmaker wants a position at once; highest ref.; could take charge. Box 143, AMERICAN MACHINIST.

Pattern maker of long experience, desirous of a change, wishes permanent position. Box 153, AMERICAN MACHINIST.

Young man with practical mechanical ability desires situation as machinery salesman. F. H. F., AMERICAN MACHINIST.

A good practical draftsman desires position; first-class shop and office experience. Box 137, AMERICAN MACHINIST.

An experienced foreman on engines and general machine-shop work desires position. Box 123, AMERICAN MACHINIST.

Wanted—Situation by first-class molder on loam, dry and green sand; or take charge of shop. Box 139, AMERICAN MACHINIST.

Mechanical engineer, having good technical and business training, desires position with horseless-carriage concern. Box 129, A. MACH.

Position wanted as foreman of machine shop or brass room; 18 years' experience; A No. 1 references; held last position 7 years. Box 155, AMERICAN MACHINIST.

A good practical mechanical superintendent is open to an engagement; general and special machinery, tools, jigs, fixtures, etc.; iron or brass. Box 144, AMERICAN MACHINIST.

An engineer and business man, 20 years experience, desires a position as engine or machinery salesman; large acquaintance amongst manufacturers. Box 128, AM. MACHINIST.

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vouched for, that in the work for the Western markets there is not quite the attention paid to minutia of detail in finish that is beheld in the Eastern centers. The remark may be apocryphal, at least it is novel.

Locally quite an effort seems to be made by a large electrical company to induce small manufacturers to adopt electrical motors and to obtain their power from outside currents. It is said that some buildings are being fitted up here with a view to that method of supplying power and that it is meeting with success.

Every day brings to the electrical machinery manufacturers inquiries for motors from printing establishments. One of the largest printers in this city says that within ten years no printing establishment will be found that is not so equipped.

The Crocker-Wheeler Electric Company last week sold its one hundred and second motor to the R. R. Donnelley & Sons Company, printers, of this city. It has just fitted out the Western Newspaper Union and A. R. Barnes & Co. with a large number of motors.

Among recent orders of Kohler Bros. are a 350 horse-power generator and twenty motors for the Fish Wagon Company, Racine, Wis., and a 75 kilowatt generator and several motors for the Plano Manufacturing Company, of this city.

CHICAGO SUPPLY MARKET.

(Held from last week.)

For a few of the finer grades of machinists' supplies there is palpable scarcity. Twist drills are hard to obtain in large lots from makers. For dividers, calipers and similar goods, upon which considerable work must be placed, the present demand exceeds the supply, and reports from shops are that overtime is not sufficient to keep even with the inquiry. But for the generality of supplies, no complaint is heard of underproduction. They are moving from works and from store in constantly increasing quantities, but makers are equal to the situation. Prices have a tendency to advance, but the change in that direction is not remarkable.

A local machinery man, who knows every shop in the city and the names of most machinists, says that he knows of no shop that is not now in operation, and that most of the machine shops are running overtime. Even at this very satisfactory state of activity it is almost impossible to obtain any work from the shops with any degree of promptness. This state of activity presupposes a corresponding briskness for machine supplies. There is a deficit both in tools and men. The same machinery man quoted above says that he has many applications from manufacturers for workmen, and that for weeks he has had a place for a pattern maker at $4 per day, but that he cannot

(*Continued on page 41.*)

Situations Wanted—Cont'd.

Wanted—By mechanical engineer, position to take charge of works, factory or steam plant; 10 years' exp. as machine shop supt.; best references. Box 151, AMER. MACHINIST.

Designer, technical graduate, now chief draftsman with large Western firm, desires similar position, or installing engineer, with growing firm appreciating energy. Box 145, AMERICAN MACHINIST.

Mechanical draftsman, Swede, technical graduate, 10 years' experience in this country, wants position; steam engines, blast furnaces, general mach., preferred; mod. terms; best refs. Box 152, AMERICAN MACHINIST.

Wanted—By an engineer and manufacturer in general engineerng work, a position as manager of works; or would like to join a new enterprise of engineering and founding; can introduce desirable lines of specialties; has extensive experience in all departments. Address "Originator," AMERICAN MACHINIST.

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An experienced Swedish foundryman, familiar with improved methods of casting steel, especially dynamo steel, can obtain a steady position as foreman at a steel works in Sweden. Apply, stating age, experience and wages wanted, to Bangbro Steel Works, Bangbro, Sweden (G. 76392).

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Foundry foreman wanted by concern of high standing in Western New York; only 10 molders, but will pay good wages to competent man who is able to get out first-class machine castings at reasonable cost and can handle help to advantage; steady position. Address, with full particulars, Box 140, AMERICAN MACHINIST.

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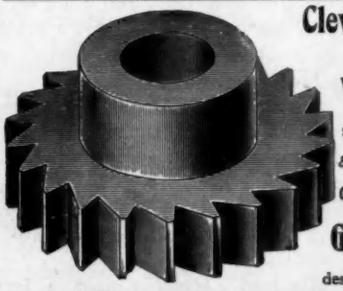

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W. R. SAWYER, Lessee.
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GEARS of all descriptions.

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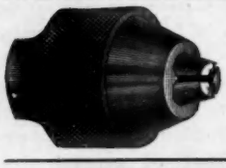

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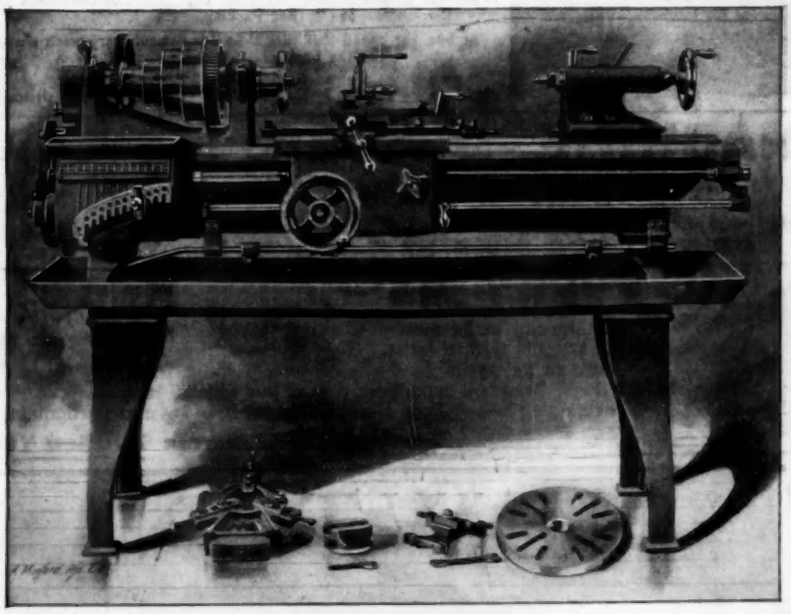

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Lard Oil—Prime city, present make, the leading brand, 45 @ 46c., in wholesale lots; some a shade less.

(*Continued from page 39.*)

vouched for, that in the work for the Western markets there is not quite the attention paid to minutia of detail in finish that is beheld in the Eastern centers. The remark may be apocryphal, at least it is novel.

Locally quite an effort seems to be made by a large electrical company to induce small manufacturers to adopt electrical motors and to obtain their power from outside currents. It is said that some buildings are being fitted up here with a view to that method of supplying power and that it is meeting with success.

Every day brings to the electrical machinery manufacturers inquiries for motors from printing establishments. One of the largest printers in this city says that within ten years no printing establishment will be found that is not so equipped.

The Crocker-Wheeler Electric Company last week sold its one hundred and second motor to the R. R. Donnelley & Sons Company, printers, of this city. It has just fitted out the Western Newspaper Union and A. R. Barnes & Co. with a large number of motors.

Among recent orders of Kohler Bros. are a 350 horse-power generator and twenty motors for the Fish Wagon Company, Racine, Wis., and a 75 kilowatt generator and several motors for the Plano Manufacturing Company, of this city.

CHICAGO SUPPLY MARKET.
(Held from last week.)

For a few of the finer grades of machinists' supplies there is palpable scarcity. Twist drills are hard to obtain in large lots from makers. For dividers, calipers and similar goods, upon which considerable work must be placed, the present demand exceeds the supply, and reports from shops are that overtime is not sufficient to keep even with the inquiry. But for the generality of supplies, no complaint is heard of underproduction. They are moving from works and from store in constantly increasing quantities, but makers are equal to the situation. Prices have a tendency to advance, but the change in that direction is not remarkable.

A local machinery man, who knows every shop in the city and the names of most machinists, says that he knows of no shop that is not now in operation, and that most of the machine shops are running overtime. Even at this very satisfactory state of activity it is almost impossible to obtain any work from the shops with any degree of promptness. This state of activity presupposes a corresponding briskness for machine supplies. There is a deficit both in tools and men. The same machinery man quoted above says that he has many applications from manufacturers for workmen, and that for weeks he has had a place for a pattern maker at $4 per day, but that he cannot

(*Continued on page 41.*)

Situations Wanted—Cont'd.

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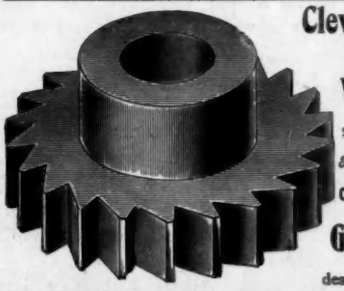

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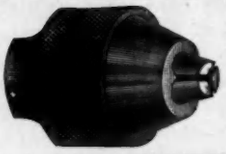

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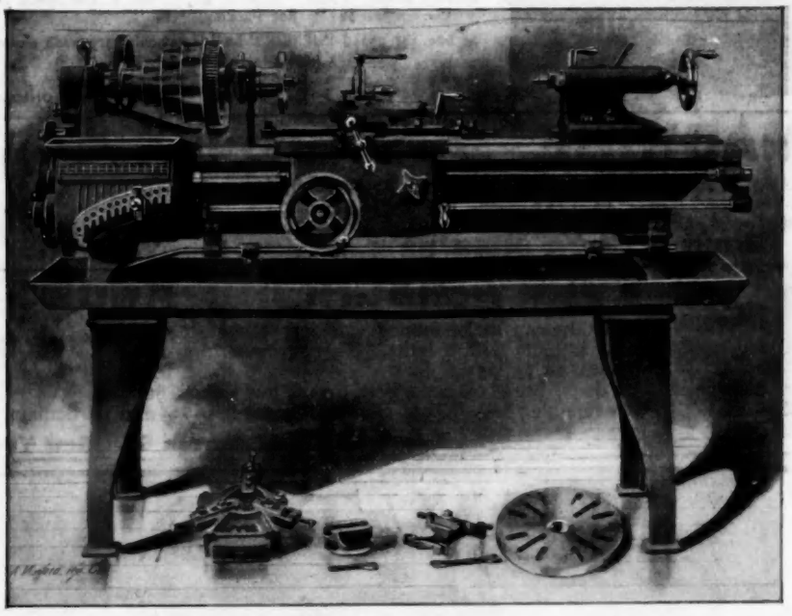

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Manufacturers.

Magnetile Foundry Company, St. Louis, Mo., is to erect a foundry, to cost $10,000.

The Royersford Machine Company, Royersford, Pa., will erect a foundry and machine shop.

The Quakertown (Pa.) Stove Works, which were destroyed by fire recently, will be rebuilt on the old site.

Joesting & Schilling, St. Paul, Minn., have taken a building permit for the erction of a $3,500 addition to their foundry.

F. Kempsmith, Milwaukee, Wis., has obtained a building permit to erect an addition to his machine shop to cost $4,000.

A new boiler shop is being built at the Burlee Dry Dock Company's yard, Port Richmond, S. I. The structure will be built of steel.

The Reading Screw Company will remove its plant from Philadelphia to Norristown, Pa., where it will erect a brick factory, 50 by 163 feet.

Messrs. J. T. & T. J. Oliphant, of the new Vincennes Bridge Manufacturing Company, Vincennes, Ind., are preparing to erect their new plant.

The Wyoming Manufacturing Company will rebuild its plant at Lansdale, Pa., recently destroyed by fire. The company manufactures textile goods.

William Tod & Co., founders and machinists, have purchased land adjoining their present plant at Youngstown, Pa., and will erect a mammoth machine shop.

Webber & Philbrick, Waterville, Me., are contemplating enlarging their machine shop in the spring by building an extension 60 feet in length on the south end of it.

The Smith-Hill Elevator Company, of Quincy, Ill., has sold its entire business to the Otis Elevator Company, of New York, and will shortly remove to Chicago.

The Frank-Kneeland Machine Company has received a contract for the erection of a plant for the National Enameling & Stamping Company, at St. Louis, to cost about $1,000,000.

The Sargent Manufacturing Company, Muskegon, Mich., has awarded the contract for the building of the large addition to its present plant to Alexander McIntosh and Robert Miller.

The Rahn & Mayer Company, Cincinnati, Ohio, has purchased all the assets and has assumed all the liabilities of the firm of Rahn & Mayer. The capital and facilities will be increased.

The plans for the new factory which the Norris Manufacturing Company, Glens Falls, N. Y., proposes to build this spring are completed. The new factory will be a two-story brick structure.

The Edward P. Allis Company, Milwaukee, Wis., is considering the erection of an addition of 150x600 feet to the east part of its plant. The building is to be of brick, and three stories in hight.

B. M. Gallwain will build a one-story boiler and engine shop, 70x40 feet, at Nos. 717 to 725 North Fourth street, Philadelphia, Pa. Eventually it will be enlarged to four stories and used as a brewery.

The Foster-Liebbe Company, Des Moines, Ia., has just completed plans for a new three-story machine shop to be erected within the walls of the Fort Madison Penitentiary, and which will cost about $6,000.

The plant of the Patton Wooden Manufacturing Company, at Patton, Pa., was destroyed by fire Thursday morning. The fire is supposed to have originated in the boiler room. The loss on building and machinery is $8,000, with an insurance of $5,000.

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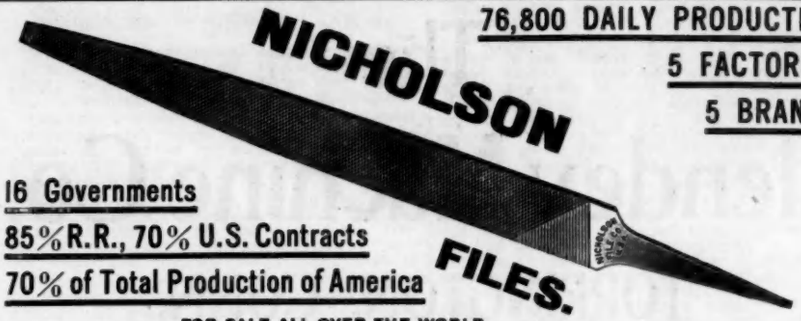
5 FACTORIES
5 BRANDS



16 Governments
85% R.R., 70% U.S. Contracts
70% of Total Production of America

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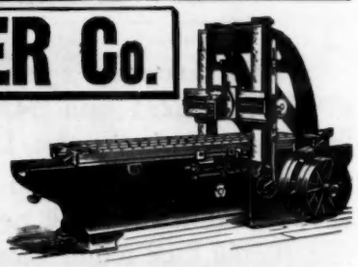
NICHOLSON FILE CO., Providence, R. I., U. S. A.

POWELL PLANER Co.



WORCESTER, MASS.

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J. A. Fay & Egan Co., 26 South Canal St., Chicago, Ill.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy Co., 502 North 2d St., St. Louis, Mo.
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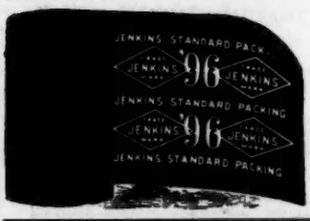

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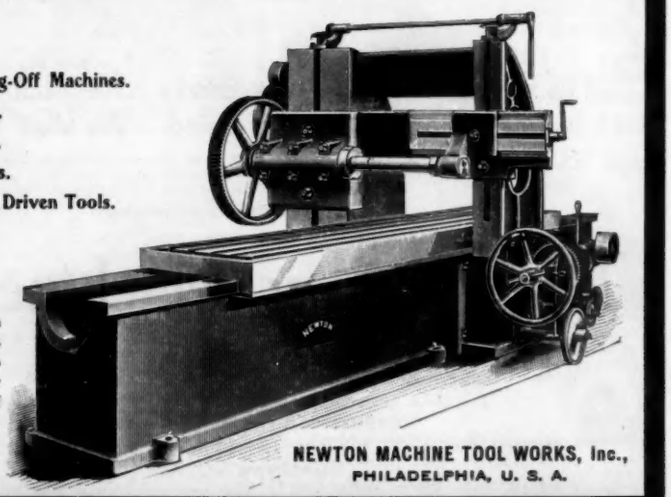

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